

Process Analysis - Sample Case

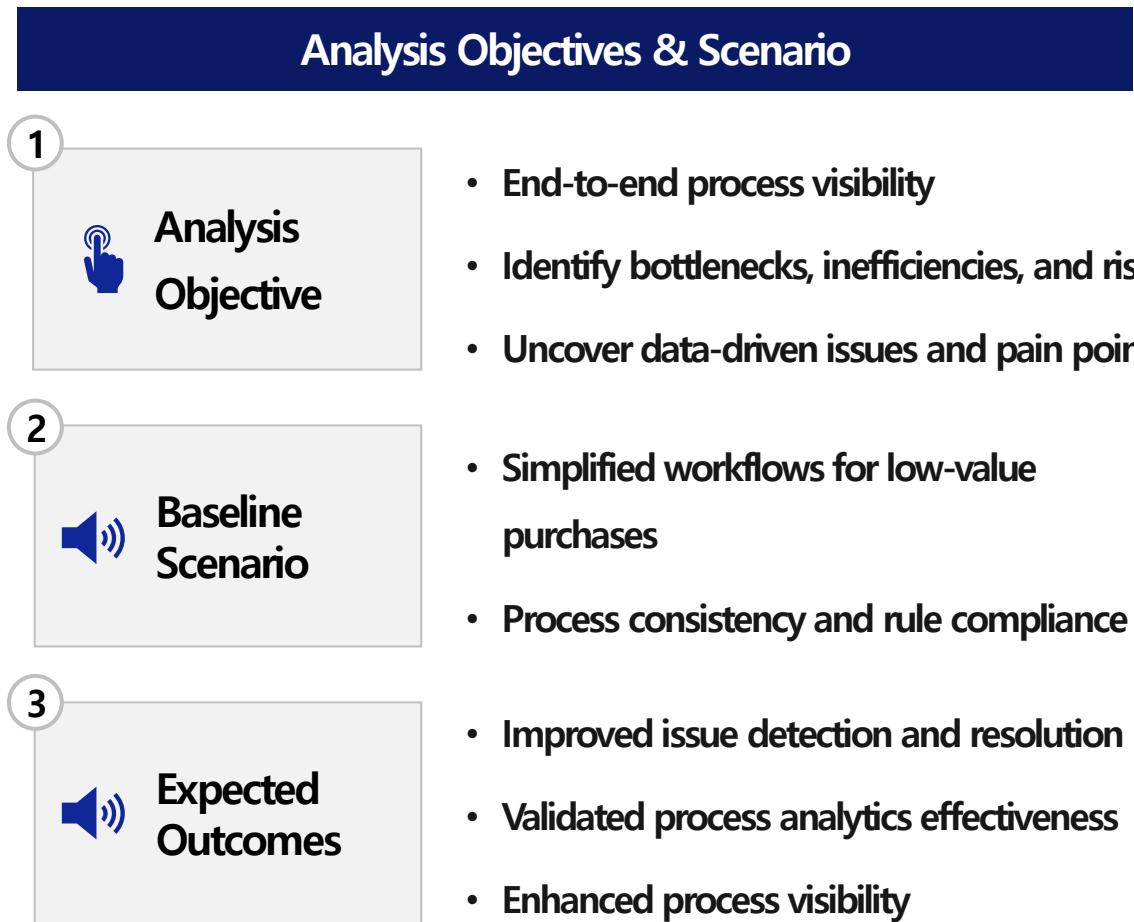
Minwoo Park

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1. Project Overview

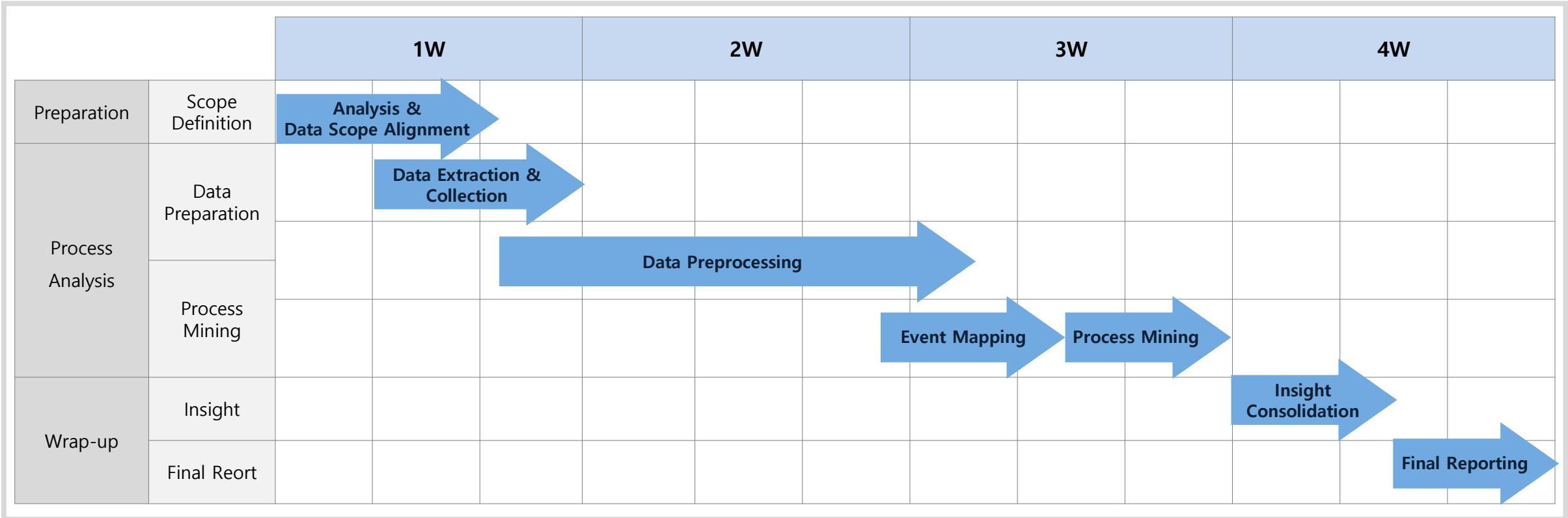
This project aims to evaluate compliance in internal procurement workflows and deliver data-driven insights for improving data management practices.



2. Project Timeline & Execution Overview

Project Execution & timeline

- Conducted data preparation, process analysis, and insight generation for an internal procurement system (4-week timeline)



Follow-up Analysis 1: Conducted in alignment with the progress of operational improvement actions

- Data Extraction & Preparation**
 - Secure and verify datasets based on defined analysis scenarios
- Data Preparation**
 - Transform data into analysis-ready formats

- Process Mining**
 - Analyze process performance and deviations
 - Visualize end-to-end processes
 - Identify process inefficiencies

- Insight & Recommendations**
 - Validate findings with stakeholders (fact-checking)
 - Identify meaningful, data-driven insights
 - Derive improvement opportunities based on key insights

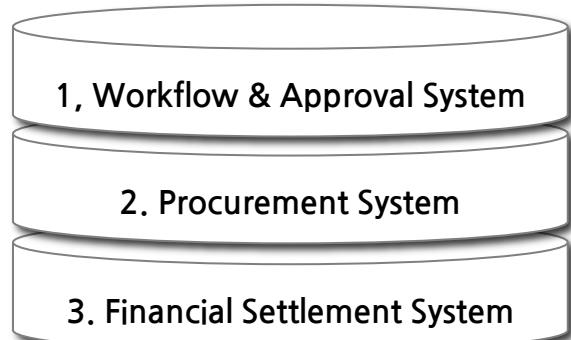
3. Analysis Overview

Internal Procurement Process Flow



Data Source Utilized

※ Approximately one year of historical data used



- Multiple internal systems were used as data sources
- Data entry, approvals, and processing occurred across systems throughout the process
- Procurement and workflow systems were integrated, with transactional data exchanged between systems

1. Procurement System

- Event P1 – Request Created
- Event P2 – Vendor Identified
- Event P3 – Contract Recorded
- Event P4 – Order Issued
- Event P5 – Goods Received
- Event P6 – Inspection Completed
- Event P7 – Payment Triggered

2. Workflow & Approval System

- Event W1 – Approval Requested
- Event W2 – Review In Progress
- Event W3 – Approval Completed
- Event W4 – Revision Requested
- Event W5 – Final Decision Recorded
- Event W6 – Status Updated

Event Types (Anonymized)

Request Events

- Request Submitted
- Request Updated
- Request Completed

Vendor & Contract Events

- Vendor Selection Recorded
- Contract Created / Updated

Order Events

- Order Created
- Order Modified
- Order Completed

Receiving & Inspection Events

- Goods Received
- Inspection Completed

Payment Events

- Payment Submitted
- Payment Approved

Event labels and system structures have been abstracted and anonymized for portfolio presentation.

3. Analysis Overview

Analysis Scenario

Category	No	Analysis Scenario	Status	Notes
Procurement Process	1	Effectiveness of simplified workflows for low-value purchases	Initial Analysis Completed	-
	2	Relationship between order amount and delivery lead time	Initial Analysis Completed	
	3	Drivers of long process lead-time outliers	Initial Analysis Completed	
	4	Impact of approval roles on total cycle time	Initial Analysis Completed	

2. Procurement System RAW

	Before 前	After 後
Total Events	5,000	2,500
Cases	350	250
Activities	30	12

1. Workflow & Approval System

	Before 前	After 後
Total Events	9,000	9,000
Cases	40,000	30,000
Activities	7	10

Data Preprocessing Workflow & Summary

- Format Standardization
 - Standardized field names across systems to enable common key-based mapping
 - Unified timestamp format (YYYY-MM-DD HH:MM:SS)
 - Standardized currency units to (KRW)
- Removal of Irrelevant Data
 - Removed cases with missing or invalid activity values
 - Eliminated duplicate activities
 - Excluded records with non-identifiable or ambiguous titles
- Dataset Integration
 - Integrated data and generated approval documents by submission status
 - Mapped datasets across systems using standardized title fields
 - Joined only attributes required for analysis from raw source data
- Transformation to Analytics-Ready Structure
 - Generated additional timestamps (e.g., order placed, goods received) to improve process continuity
 - Reconstructed cross-system data relationships into a unified event log
 - Defined and configured key analytical factors

All figures have been modified and anonymized for portfolio presentation purposes.

4. Data Preprocessing



Final Data

2. Procurement System RAW

	Before 前	After 後
Request Created	(700, 10)	(610, 10)
Vendor Identified	(700, 12)	(357, 14)
Contract Recorded	(700, 25)	(390, 28)
Order Issued	(700, 13)	(125, 15)
Goods Received	(680, 11)	(600, 11)
Inspection Completed	(700, 10)	(370, 10)
Payment Triggered	(700, 10)	(230, 10)

System 1 & System 3

	Before 前	After 後
System1 A	(2200, 8)	(7000, 6)
System2 A	(6800, 8)	
System1 B	(7000, 9)	(29800, 7)
System2 B	(32000, 10)	

Final Data

(Filtered Cases with Complete Process Compliance)

Analysis Period
20yy-mm-05 09:15
-
20yy-0mm-18 22:40

Filtered Cases
164
Total Cases
280
Coverage
58.6%

Filtered Events
1,245
Total Events
1,760
Coverage
70.7%

Filtered Activities
15
Total Activities
18
Coverage
83.3%

Raw Data						
CaseID	Y/N	R-Number	Order	Name	Status	Currency
case-10	Y	0014	1	Hey	Finished	KRW
case-10	Y	0012	1	Ya	Finished	KRW
case-10	Y	0011	1	Yes	Finished	KRW
case-10	Y	0011	1	Ya	Finished	KRW
case-10	Y	0010	1	Office	Finished	KRW

Final Data (one timestamp)

	CaseID	Activity	Approval order	Time1
1	case-10	1.step1	1	2023-01-12 17:10
2	case-10	2-1.step2-1	1	2023-01-18 18:14
3	case-10	3. step3	1	2023-01-19 23:59
4	case-10	4.step4	1	2023-01-19 23:59
5	case-10	6.step6	1	2023-06-27 10:48

&

Final Data (two timestamp)

	CaseID	Activity	Time 1	Time 2
1	case-10	1.step1	yyyy-mm-07 18:07	20yy-0m-08 15:35
2	case-10	3. step3	yyyy-mm-30 23:59	20yy-0m-30 23:59
3	case-10	4. step4	yyyy-mm-31 00:00	20yy-0m-31 00:01
4	case-10	5. step5	yyyy-mm-01 15:33	20yy-0m-02 13:34
5	case-10	6.step6	yyyy-mm-16 15:25	20yy-0m-27 10:48

CaseID Activity Timestamp

All figures have been modified and anonymized for portfolio presentation purposes.

3 Components for Process Mining

4. Data Preprocessing | System Connection

The procurement and payment systems lack native timestamps, requiring integration with the groupware system to enable process mining analysis.

[Procurement]

CaseID	Department	Requester	Request ID	Purchase Title	Purchase Type
Case-10	Team B	A	ID123	Hey Pohang	Goods
Case-10	Team B	B	ID123	Yoa Tower	Service
Case-10	Team F	C	ID123	Hey Tower Essential	Service

[Workflow & Approval]

Document ID	Form Name	Title	Created Date	Completed Date
Y2025	Request	Hey	20yy-mm-10	20yy-mm-11
Y2025	Request	Tower	20yy-mm-21	20yy-mm-22
Y2025	Request	Essential	20yy-mm-19	20yy-mm-20

Title-based mapping with consideration
of form names (exact / similar)

[Payment]

CaseID	Title	Sequence	Status	Approval Time	Approval	Department	Final Status
0050	Hey Tower Essential	1	Approved	20yy-mm-27 13:20	B	Team B	Approved
0050	Hey Tower Essential	2	Approved	20yy-mm-28 14:39	Team A	Team A	Approved
0050	Hey Tower Essential	3	Approved	20yy-mm-28 16:55	D	Team A	Approved
0050	Hey Tower Essential	4	Approved	20yy-mm-28 17:05	F	Team B	Approved

[Payment + Workflow] + 6. Step 6 Connection

4. Data Preprocessing | Final Data Set

The analysis dataset was created by integrating three data sources.

Depending on each analytical objective, data from the most appropriate system was selectively utilized.

Analysis Dataset Definition

Procurement

Payment

Approval

[FinalData]

	CASEID	Activity	Time Stamp						
	Reference ID	Activity Name	Created Date	Completed Date	Title	Document ID	Stage Key	Form Name	Type
1	Case-10	Step1	yy-mm-dd 18:07	yy-mm-dd 15:35	Request Furniture	0090	0004	Procurement	Goods
2	Case-10	Step3	yy-mm-dd 23:59	yy-mm-dd 23:59	Request Furniture		P022		Goods
3	Case-10	Step4	yy-mm-dd 0:00	yy-mm-dd 0:01	Request Furniture		0002		Goods
4	Case-10	Step5	yy-mm-dd 15:33	yy-mm-dd 13:34	Request Approval	0076	0095	Request	Goods
5	Case-10	Step6	yy-mm-dd 15:25	yy-mm-dd 10:48	Tower Furniture	0076	1014		Goods
6	Case-100	Step1	yy-mm-dd 18:07	yy-mm-dd 15:35	Request Furniture	0090	1004	Procurement	Goods
7	Case-100	Step3	yy-mm-dd 23:59	yy-mm-dd 23:59	Tower Table		1020		Goods
8	Case-100	Step3	yy-mm-dd 0:00	yy-mm-dd 0:01	Tower Table		0003		Goods
9	Case-100	Step5	yy-mm-dd 13:01	yy-mm-dd 13:45	Request	0014	1265	Procurement Inspect	Goods
10	Case-100	Step6	yy-mm-dd 11:45	yy-mm-dd 20:11	Tower Furniture	0014	0013		Goods
11	Case-110	Step1	yy-mm-dd 18:07	yy-mm-dd 15:35	Tower Furniture	0090	0003	Request Inspect	Goods
12	Case-110	Step3	yy-mm-dd 23:59	yy-mm-dd 23:59	Tower Furniture		0010		Goods
13	Case-110	Step4	yy-mm-dd 0:00	yy-mm-dd 0:01	Tower Furniture		0003		Goods
14	Case-110	Step5	yy-mm-dd 13:01	yy-mm-dd 13:45	Report for 3 Case	0014	1266	Request Inspect	Goods
15	Case-110	Step6	yy-mm-dd 11:45	yy-mm-dd 20:11	Report for 3 Case	0014	0124	Goods	Goods
16

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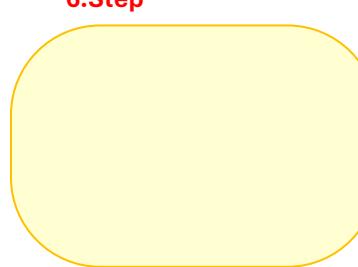
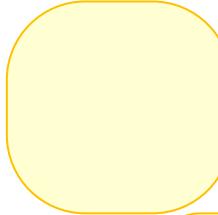
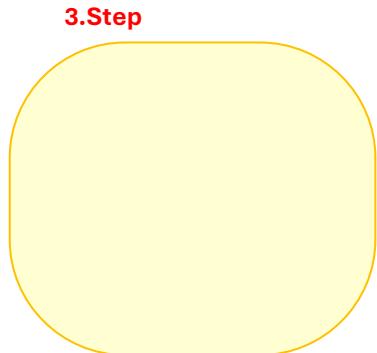
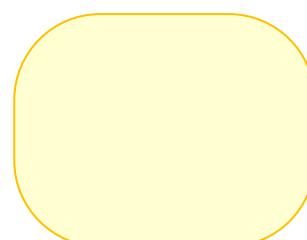
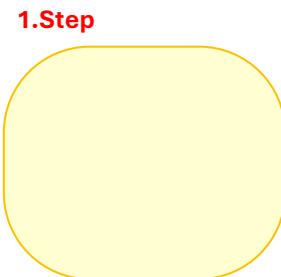
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5. Key Findings
6. Recommendation

Process Visualization | Standard / Actual Process

Standard Process

Confidential (Details Omitted)

Actual Process



Node 99.3%
Path 96.5%
Activity Count 12 / 15

“Detailed process steps are intentionally omitted due to confidentiality constraints.”

Process Visualization | Actual Process



Top Procurement Process Patterns (n=anonymized)

➤ Pattern A (Standard Flow)

Purchase Request → Vendor Selection → Order Issued → Goods Received → Inspection Completed → Payment Approved

➤ Pattern B (Order Revisions Observed)

Purchase Request → Vendor Selection → Order Issued → Order Modified → Goods Received → Inspection → Payment Approved

➤ Pattern D (Repeated Order Changes)

Purchase Request → Vendor Selection → Multiple Order Changes → Goods Received → Inspection → Payment Approved

Case	Duration	
Coun ▾	Ratio(%)	Avg.
Confidential (Details Omitted)		

Process Conformance Summary

- 83.5% of procurement cases followed the standard process
- 16.5% deviated from the standard flow

Case	Duration	
Coun ▾	Ratio(%)	Avg.
Confidential (Details Omitted)		

Non-Conforming Patterns Type

- Type A : Order initiated before purchase request registration
- Type B : Purchase request registered after goods receipt
- Type C : Contract finalized after order issuance

Case	Duration	
Coun ▾	Ratio(%)	Avg.
Confidential (Details Omitted)		

Analysis Scenario – Summary of Results

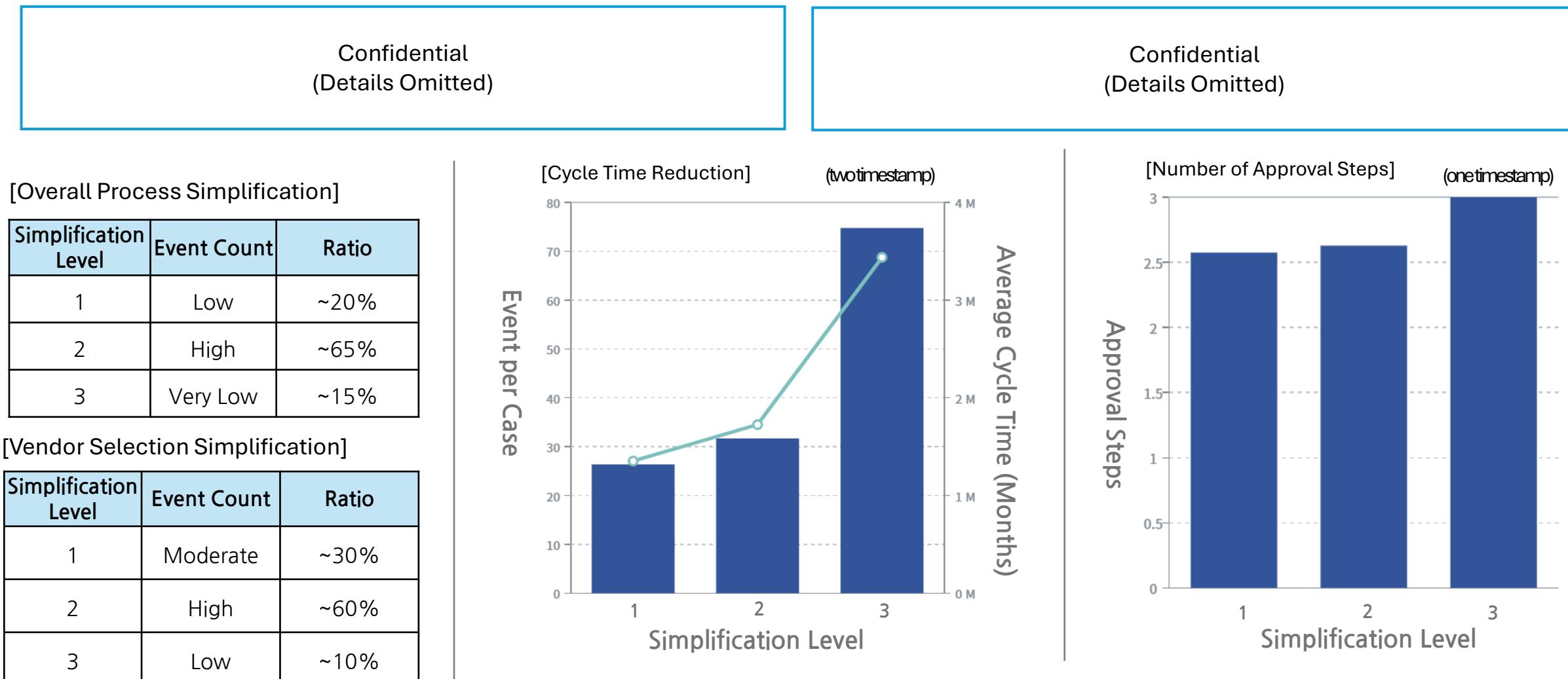
	No	Analysis Scenario	Key Findings	Status	Notes
Process	1	Simplified workflows are effectively applied to low-value procurement transactions.	Low-value purchases are processed more quickly through streamlined procedures.	Initial Analysis Completed	-
	2	There is a relationship between purchase amount and procurement processing speed.	Lower purchase amounts are associated with faster processing times.	Initial Analysis Completed	
	3	Cases with longer-than-average lead times (based on process start) are expected to have identifiable causes.	Waiting time for specific activities is a key contributor (e.g., payment approval).	Initial Analysis Completed	
	4	Approval responsibility and delays in specific departments are correlated with total process duration.	Approval and coordination delays in certain departments impact overall lead time.	Initial Analysis Completed	

Scenario 01:
Simplified processes are being effectively applied to low-value procurement transactions.

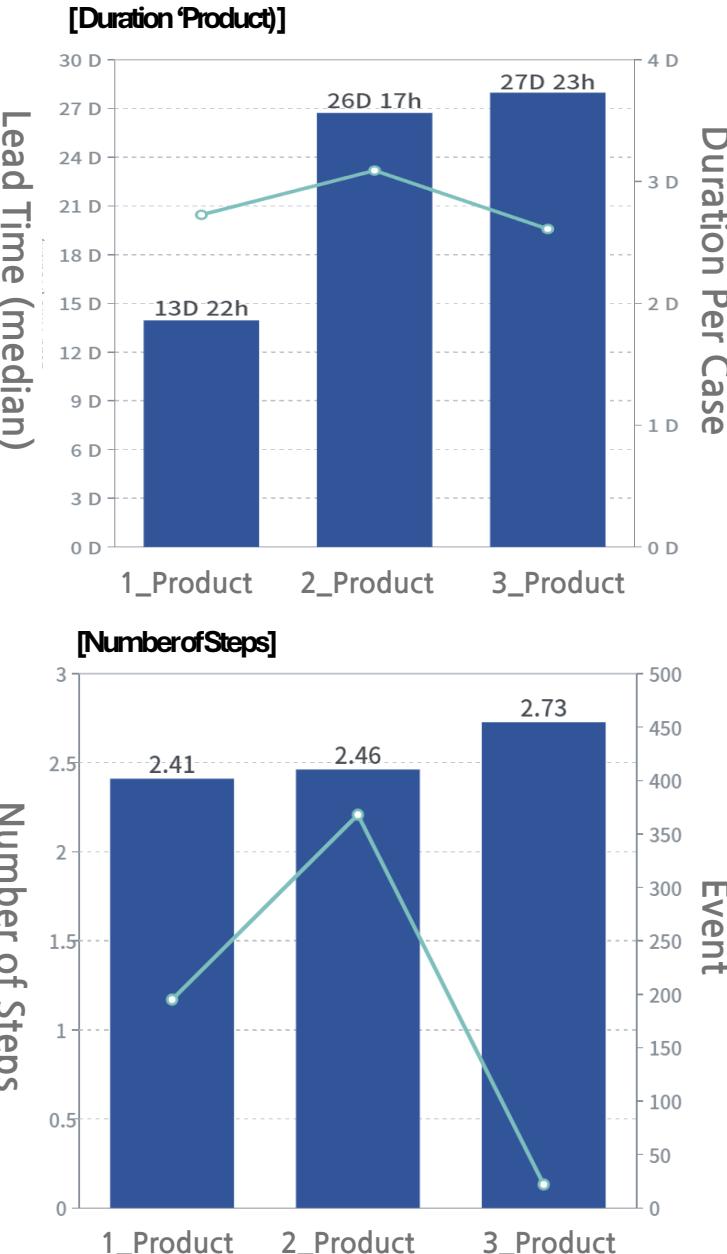
Simplified Procurement Processing Time

Scenario 1. Simplified processes are expected to be effectively applied to low-value procurement transactions.

Since detailed departmental information distinguishing the procurement team from requesting business units is not available, an authorization criteria matrix for vendor selection is used to analyze the number of approval steps and lead time by standardized process ID.



Simplified Procurement Processing Time



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(Details Omitted)

Resource

CaselD	Activity	Timestamp	Resource
0010	Step2	14h 13m	

Standard ID	Activity Name	Approval Time	Title	Sequence	Submitter	Team	Simplified
0010	Step2	yyyy-mm-18 18:14	Purchase A	1	A	A	1_Product
0010	Step2	yyyy-mm-19 10:30	Purchase A	2	B	B	1_Produt

90h 51m

Standard ID	Activity Name	Approval Time	Title	Sequence	Submitter	Team	Simplified
0010	Step2	yyyy-mm-27 16:57	Purchase A	1	A	A	3_Product
0010	Step2	yyyy-mm-28 16:02	Purchase A	2	B	B	3_Product
0010	Step2	yyyy-mm-28 18:21	Purchase A	3	C	C	3_Product
0010	Step2	yyyy-mm-02 20:09	Purchase A	4	D	D	3_Product
0010	Step2	yyyy-mm-03 13:56	Purchase A	5	E	E	3_Product

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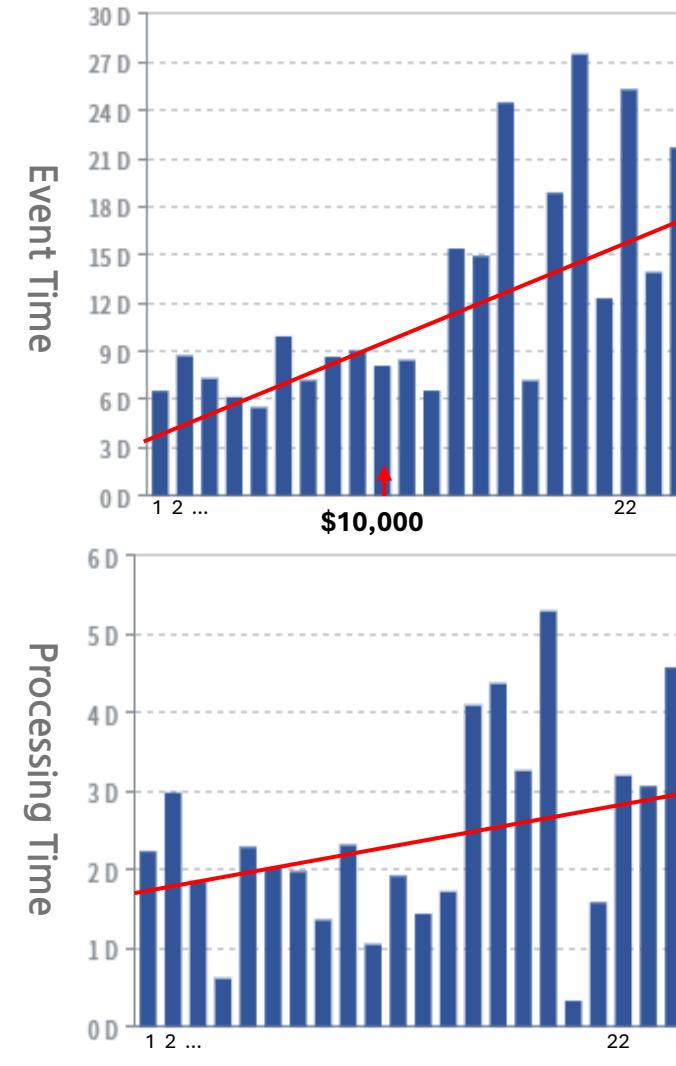
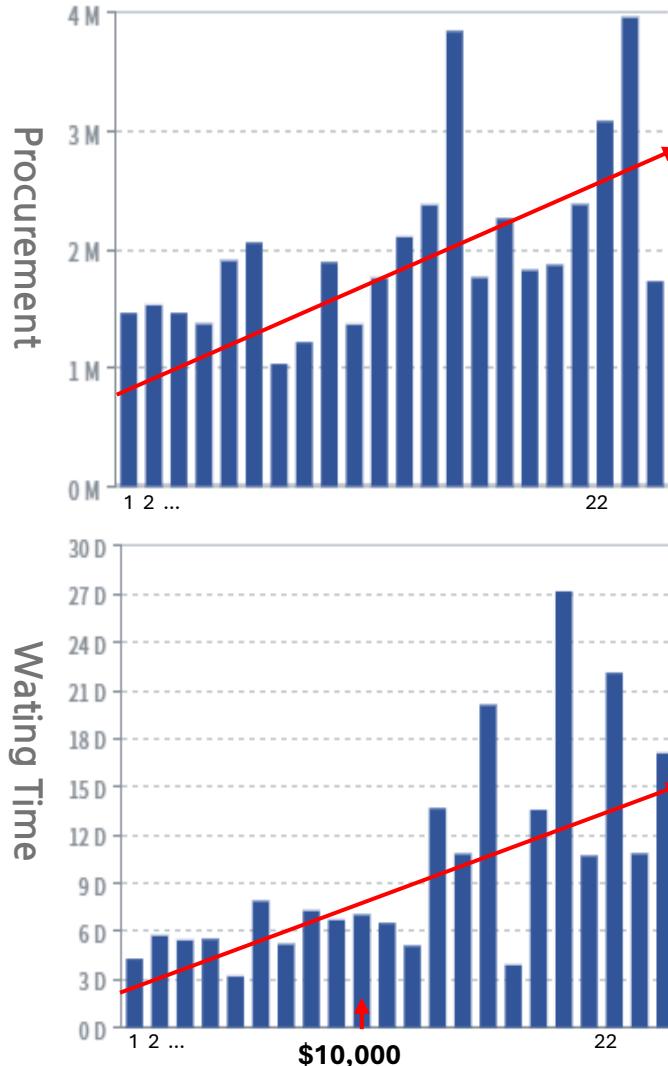
Scenario 02:

There is a correlation between purchase amount and procurement processing speed.

Analysis of Procurement Lead Time by Purchase Amount

Scenario 02. Purchase amount and delivery speed are expected to be correlated. (Effectiveness of process simplification)

[Correlation Analysis of Lead Time by Purchase Amount]



	Purchase Amount
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22

Confidential
(Details Omitted)

Scenario 03:

Cases with longer-than-average lead times are expected to have identifiable causes.

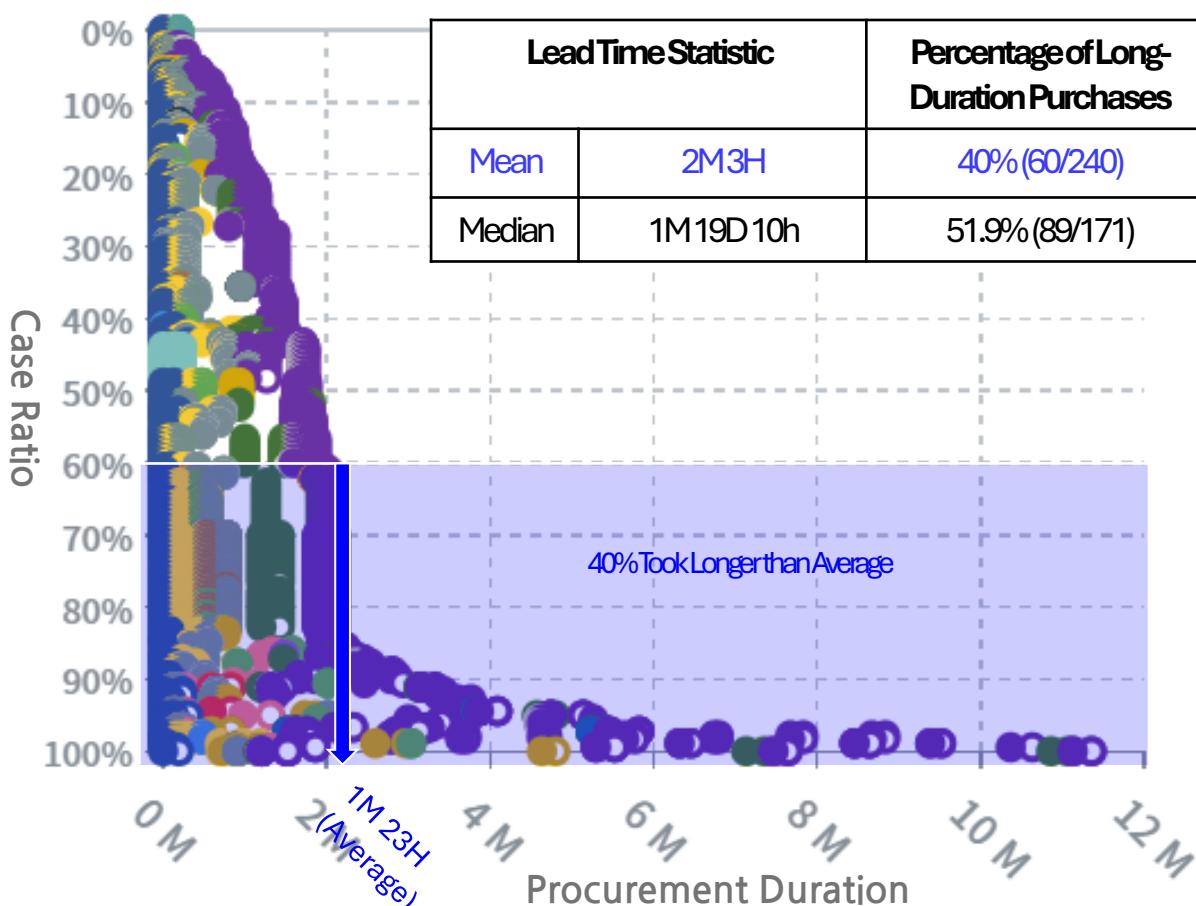
Analysis of Long-Duration Cases

Scenario 3. Cases with longer-than-average process lead time are expected to have identifiable contributing factors.

Result

Current Status of Procurement Process Lead Time

Approval Procurement Lead Time



Understanding Dotted Chart



6. Proposal

Proposal:

- Candidate KPIs for Process Mining Expansion
- Data Integrity Establishment and Management

5. Proposal : Process Mining Expansion & Implementation

Key KPIs for Process Mining in the 'Hospitality & Travel' Industry

Key KPIs by Value Chain

Sales/Marketing	<ul style="list-style-type: none">Customer InquiryVolume Average Response Waiting Time	<ul style="list-style-type: none">Lead Time (Inquiry → Booking)Promotion Execution Count
Customer	<ul style="list-style-type: none">Number of New CustomersCustomer Satisfaction Score (CSAT)	<ul style="list-style-type: none">Customer Churn RateCustomer Complaint Resolution Time
Operations/Service	<ul style="list-style-type: none">System Downtime RateInternal / External Audit Execution Rate	<ul style="list-style-type: none">Operational Process Improvement RateInformation Security Incident Rate
Risk Management	<ul style="list-style-type: none">Risk Incident Occurrence RateLoss Amount Due to Risk Events	<ul style="list-style-type: none">Abnormal Transaction Detection RateCompliance Process Adherence Rate
HR / Performance Management	<ul style="list-style-type: none">New Hire CountEmployee Satisfaction Score	<ul style="list-style-type: none">Promotion RateEmployee Turnover Rate

5. Proposal: Establishing and Managing Data Integrity

Data Governance

Key timestamp data required to track procurement processes is currently missing.

To ensure accurate process management, it is necessary to prevent unmanaged or missing data by introducing additional timestamps and enhancing system capabilities.

Data Management

5. Purchase Request Information

1	CaseID	Department
2	Case-10	Team A
3	Case-10	Team A
4	Case-10	Team B
5	Case-20	Team B
6	Case-10	Team B
7	Case-20	Team B
8	Case-10	Team A
9	Case-10	Team D

...

Price	Type	Timestamp
\$500	Goods	
\$800	Service	
\$18,000	Service	
\$64,000	Service	
\$61,500	Service	
\$132,320	Service	
\$400,000	Service	
\$90,000	Goods	

Issue: Missing Timestamp Data

- Certain procurement and payment systems do not consistently record timestamp information.
- As a result, it is difficult to clearly distinguish request and approval timestamps at the case level.



Without timestamp data, process mining analysis cannot be performed.

“Process-level timestamp management is required.”

Thank you

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