

Practical enterprise AI No black box

Augmenting human expertise with explainable AI for improved operational performance and better business outcomes.

HMX Corporation

Intelligent Production Optimization

Proof of Value Presentation & Managed Services

December 2021



Proof of Value Goal and Scope

hmx.ai



THE GOAL IS TO DEMONSTRATE
THE CAPABILITIES OF HMX
INTELLIGENT PRODUCTION
OPTIMIZATION SOLUTION

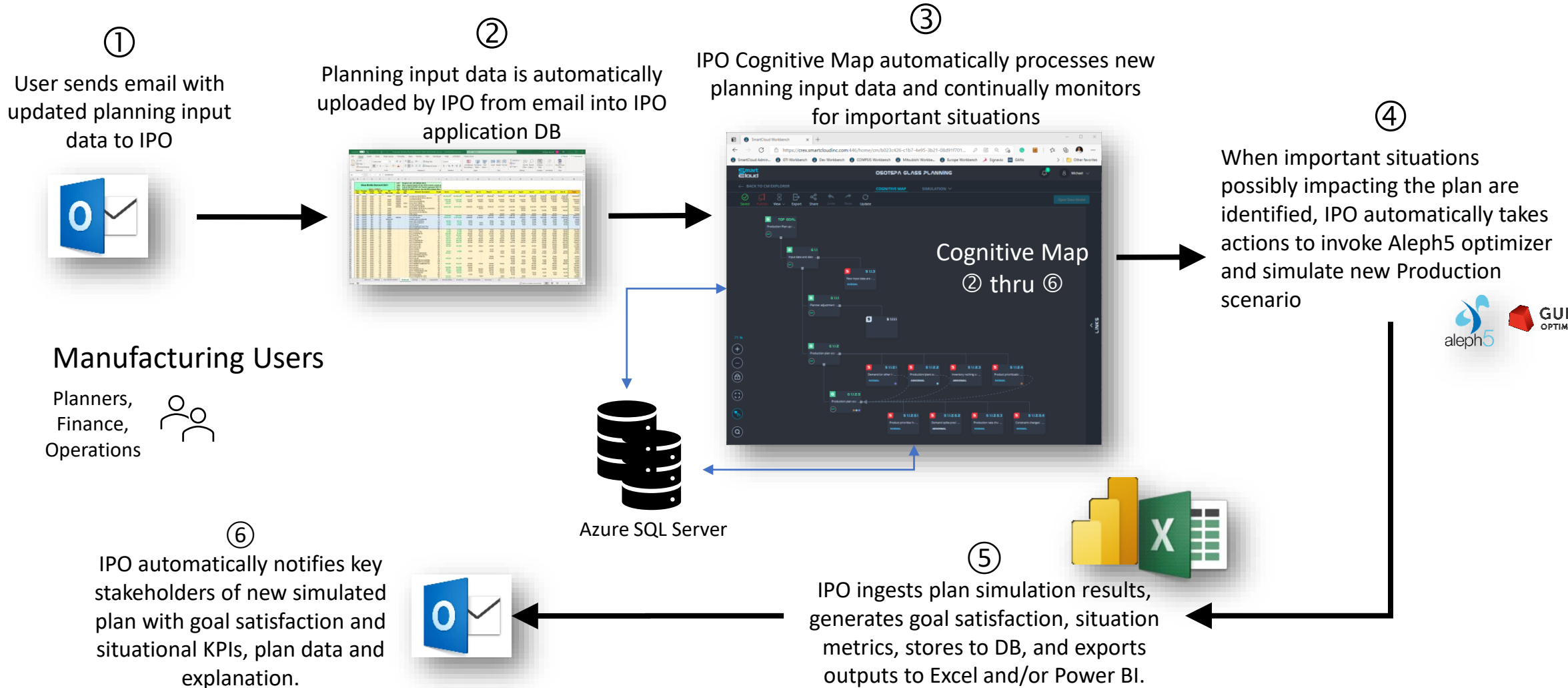


THE SCOPE IS THE
IMPLEMENTATION OF A USE
CASE FOR CONSTRAINT-BASED
PRODUCTION SCHEDULE



PROOF OF VALUE SUCCESS WILL
BE MEASURED AGAINST
MUTUALLY AGREED SUCCESS
CRITERIA

HMX Intelligent Production Optimization (IPO): User Workflow





Proof-of-Value and Production Capabilities

Example Email Notification



IPO Capability	Proof-of-Value	Production
Planning data input (step 2)	Manual, 1 example source (e.g., demand)	Automatic
Cognitive Map	Up to 5 goals/sub-goals, up to 10 situations, 1 situation triggers plan development, other situations set parameters that are used in plan development.	Multiple goals and situations, with upper limit set by license agreement
Use Cases	1 (e.g., develop a production plan for addressing a significant change in demand for beverages)	Multiple, with upper limit set by license agreement
BI Displays	Standard plan, utilization, inventory displays, IPO goal/situation metrics	IPO goal/situation metrics, plan displays specialized to manufacturer's requirements
Email notification	Example for enabled situations, and with explanation	As specified by manufacturer for each situation.

Date: 02-Aug-2021 12:00:00 AM

Situation that Triggered Plan Development: Demand for beverages has changed significantly

Situation Description: This situation occurs when the most recent demand update is significantly different from recent demand forecast and indicates a possible insufficient supply to meet that demand.

Production Plan Results

Goal Impact: The production capacity limits in plant SGA will slightly reduce % goal satisfaction for "Maximize profit".

Impact: High

Explanation:

- **Issue:** the supply of NO.003 150 CC is not sufficient to meet the predicted demand during the period from 1-Jun through 5-Jun.
- **Reason:** There is insufficient production capacity in machines currently available to produce NO.003 150 CC during the period from 1-Jun through 5-Jun.
- **Resolution:** Options include the following:
 - Change the priorities of other products to provide additional capacity.
 - Outsource production of 150,000 bottles to meet the demand.
 - Repurpose SGA #101furnace to Amber and allocate forming machines 1 and 2 to NO.003 150 CC.

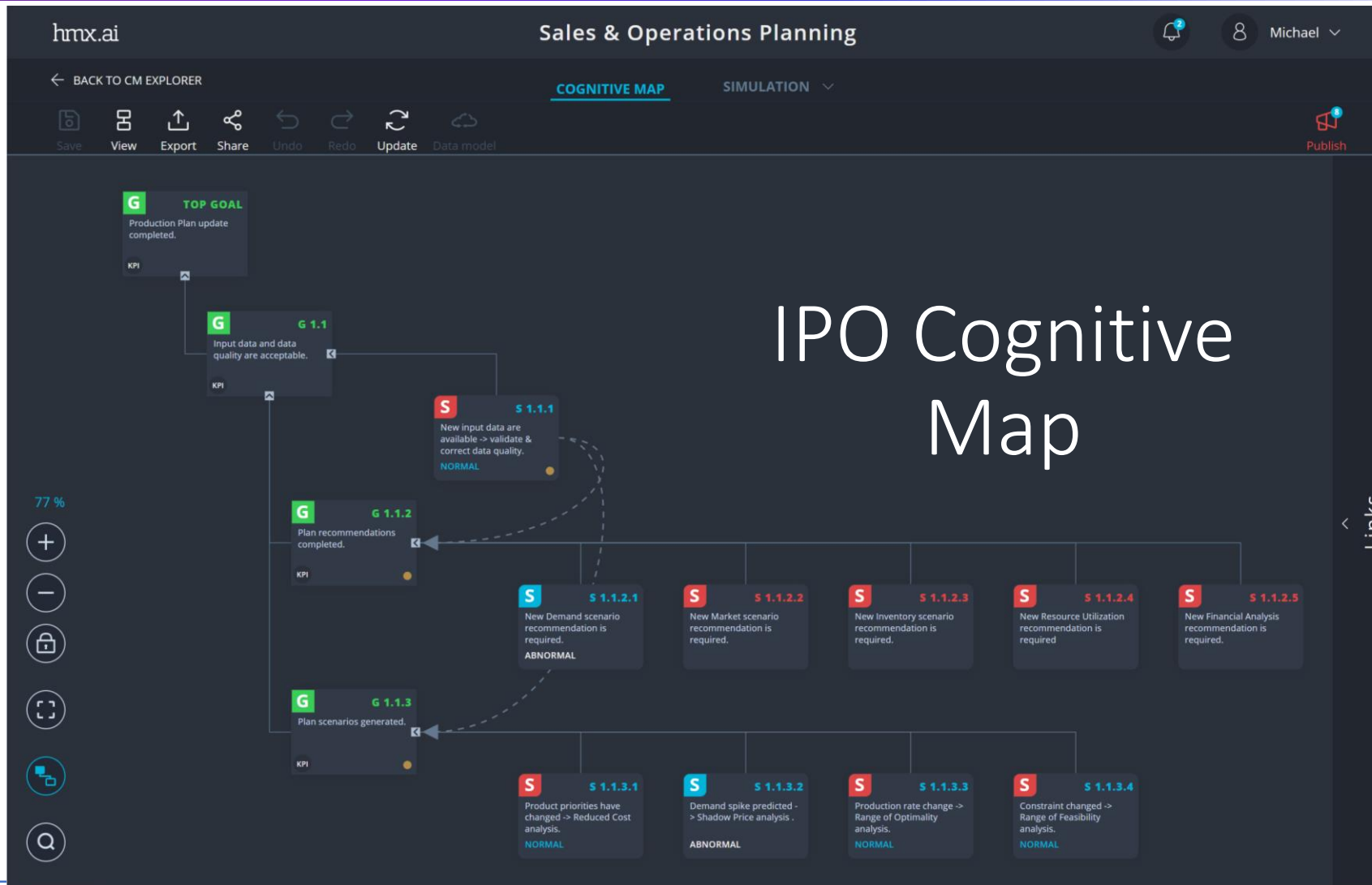
Additional Diagnostic Notes: This situation has occurred intermittently (3 times in 8 planning periods) over the last 2 months, indicating a fluctuation in reported demand.

90-Day Proof-of-Value Schedule

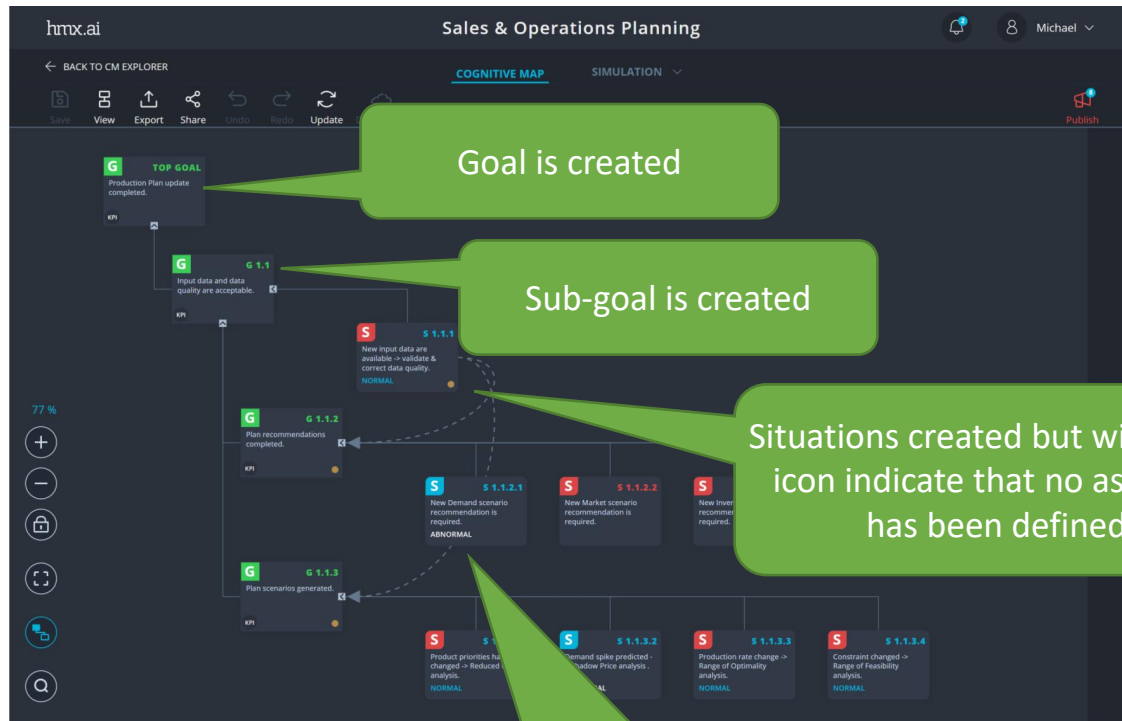


Tasks			
Start	End	Duration	Label
Day 0	Day 8	8	Finalize Letter of Agreement
Day 8	Day 13	5	Initial GDTA Preparation
Day 13	Day 18	5	GDTA Sessions over Teams
Day 18	Day 38	20	Design Document Preparation
Day 38	Day 73	35	Cognitive Map Implementation
Day 38	Day 73	35	Data Model Implementation
Day 73	Day 74	1	IPO PoV Deployment
Day 75	Day 90	15	PoV Execution

Proof-of-Value Test Cases and Success Criteria



Create a Cognitive Map



Goal is created

Sub-goal is created

Situations created but with a red icon indicate that no assessor has been defined

Situations with assessors defined are shown with blue icons.

Success Criteria

- Cognitive map is successfully published and put into operation by programming the goal traversal module, which will start processing the available data and create a production schedule:
 - Goals are successfully created and edited
 - Situations are successfully created and edited
 - Cognitive map with missing situation assessors (situations marked in red) cannot be published

Define Assessors in a Cognitive Map

hmx.ai Sales & Operations Planning

COGNITIVE MAP SIMULATION

Decision table is correct.

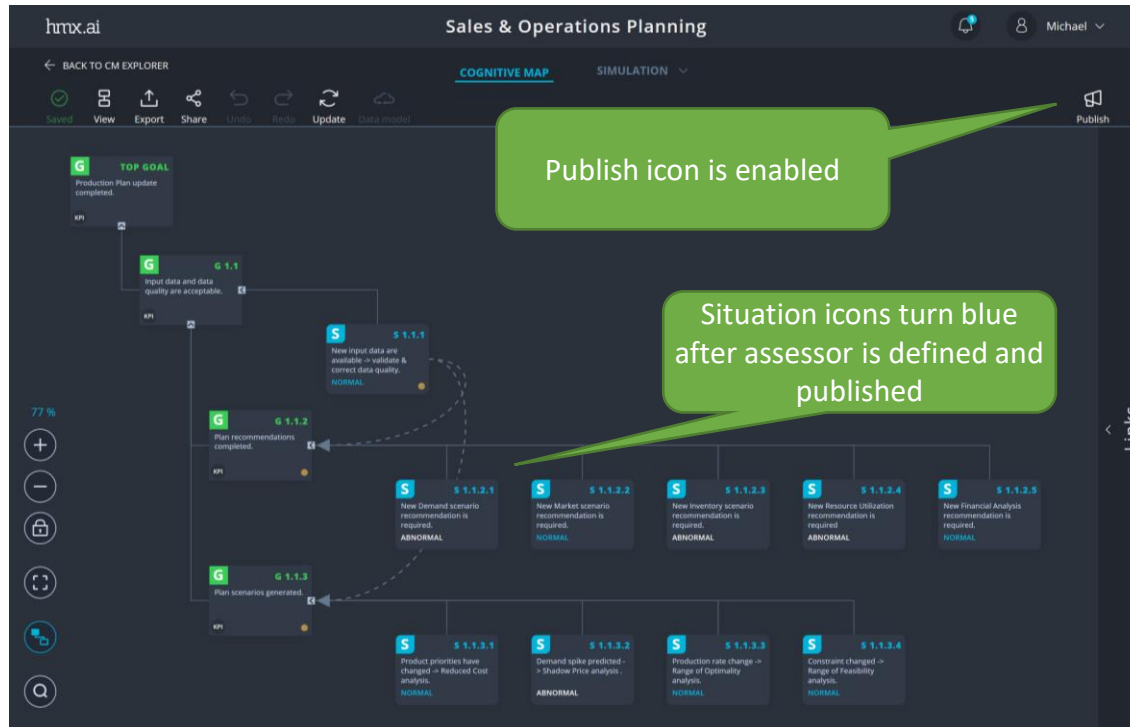
UNIQUE	IF		THEN	
	Condition 1	Condition 2	Action 1	Action 2
	Computations.Vendor.Cancel... number	Computations.Vend... integer	Application.Vendor... integer	Application.Vendor.Alarm.M... string
	+ Add term	+ Add term	+ Add term	+ Add term
1	Computations.Vendor.Ca...	Computations.Ven...	Application.Vend...	Application.Vendor.Alar...

Situational assessor is created with conditions and actions

Success Criteria

- Cognitive map is successfully published and put into operation by programming the goal traversal module, which will start processing the available data and create a production schedule:
- Situation assessors are successfully created and edited

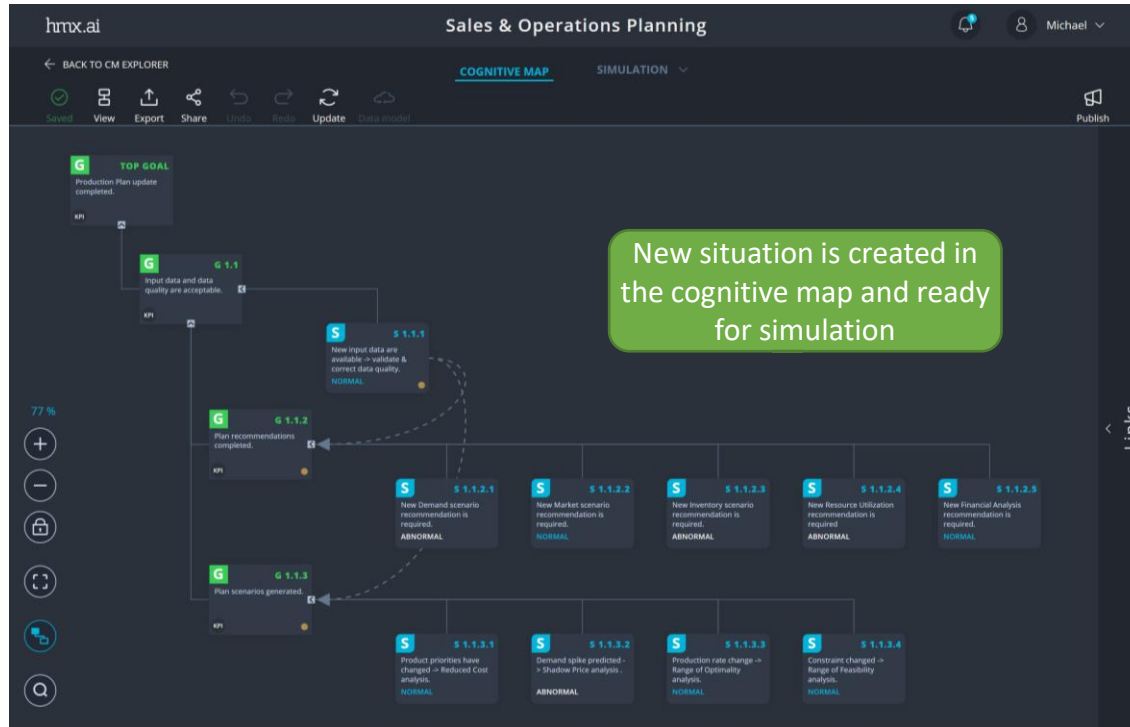
Publish a Cognitive Map



Success Criteria

- Cognitive map is successfully published and put into operation by programming the goal traversal module, which will start processing the available data and create a production schedule:
- Cognitive map with all situation assessors defined (situations marked in blue) is successfully published.

Simulate and Analyze a Cognitive Map



Success Criteria

- The new situation is created, and the cognitive map published successfully.
- Simulation runs successfully
- Simulation outputs are successfully displayed in Power BI

Simulation Enables Verification and Validation

The screenshot displays a simulation software interface with the following components:

- Navigation:** COGNITIVE MAP, BAYESIAN NETWORKS, SIMULATION (selected).
- Workflow:** 1 Add input, 2 Configure triggers, 3 View result.
- CHOOSE TRIGGERS (OPTIONALLY):** Search bar and list of triggers including Trigger 1, Trigger 30, Trigger 31, On Invoice Event, Computed Values - Simulation, Bayesian Networks - Simulation, and Vendor Impacts - Simulation.
- APPLY THE SIMULATION FOR:** Radio buttons for All situation (selected) and Specific situations.
- Simulation Tree:** A hierarchical diagram starting with a 'TOP GOAL' node, branching into various nodes such as 'Desenrollar a rate de desroll...', 'Identificar a rate de desroll...', 'Tasa de cancelación por año', 'Largo promedio en años', 'Miles de viajes por hora', 'Número de copias en un año', 'Valor diario en dólares', 'Tasa de pago por hora', and 'Probabilidad de éxito'.
- ADDED TRIGGERS:** A dashed box with the text 'Click on the table(s) to add'.
- Zoom:** A zoom control set to 100%.

IPO simulation
capability
enables what-if
scenario analysis
by experts

IPO constraint-based production schedule dashboards



Planta	Homo	Total Dias	SEP-14	OCT-14	NOV-14	DEC-14	JAN-15	FEB-15	MAR-15	APR-15	MAY-15	JUN-15	JUL-15	AUG-15	SEP-15	OCT-15
1	VC	HVC1	535.0	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF
2	HVC2	490.0	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF
3	HVC3	478.0	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF	PERF
4	VG	HVG1	491.0	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI
5	HVG2	513.0	CRI	11	CRI	CRI	11	CRI	CRI	11	CRI	CRI	11	CRI	CRI	11
6	HVG3	1,126.0	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
7	VM	HVM3	472.0	GEO	GEO	DLG	GEO	GEO	DLG	GEO	CHG	AGR	AGR	DLG	DLG	CHG
8	HVM5	556.0	GEO	GEO	GEO	GEO	GEO	GEO	GEO	GEO	GEO	GEO	GEO	GEO	GEO	GEO
9	HVM6	556.0	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI
10	HVM8	503.0	AGR	AGR	CHG	AGR	AGR	AGR	AGR	AGR	AGR	AGR	AGR	AGR	AGR	AGR
11	HVM9	556.0	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI
12	VQ	HVQ1	556.0	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI
13	HVQ2	452.0	AMB	AMB	AMB	AMB	AMB	AMB	AMB	CRI	CRI	CRI	CRI	CRI	AMB	AMB
14	HVQ3	556.0	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI
15	VR	HVR0	537.0	ESM	ESM	SKYY	SKYY	ESM	ESM	SKYY	ESM	ESM	SKYY	ESM	ESM	SKYY
16	HVR1	431.0	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	GEO	GEO	AMB
17	HVR2	488.0	GEO	GEO	ESM	ESM	GEO	CRI	CRI	GEO	GEO	GEO	GEO	GEO	GEO	GEO
18	HVR3	500.0	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI
19	VT	HVT1	527.0	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI
20	HVT2	556.0	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI	CRI

	Planta	Homo	Máquina	GLOBAL	SEP-14	OCT-14	NOV-14	DEC-14	JAN-15	FEB-15	MAR-15	APR-15	MAY-15	JUN-15	JUL-15	AUG-15
Subtotal >>		HVR0		31,271.0	3,062.2	2,360.1	3,229.4	1,103.9	2,926.9	2,824.0	1,385.2	2,967.2	2,715.5	3,072.0	2,381.9	3,242.8
65	VR	HVR1	VR11	13,846.8	1,380.3	1,573.1	1,326.0	1,028.4	0.0	201.3	1,496.6	1,424.4	1,545.5	1,309.5	1,225.0	1,336.6
66	VR	HVR1	VR12	8,112.8	1,097.0	828.3	926.6	741.5	0.0	129.9	1,045.2	1,020.4	819.9	944.1	659.8	0.0
67	VR	HVR1	VR13	3,085.7	253.6	440.1	472.7	287.8	0.0	56.9	228.3	279.8	291.7	392.8	382.1	0.0
68	VR	HVR1	VR14	18,296.8	2,334.1	2,414.8	2,334.3	1,602.9	0.0	300.3	1,499.7	1,779.5	1,738.2	1,946.9	1,616.2	730.0
Subtotal >>		HVR1		43,342.1	5,065.0	5,256.3	5,059.7	3,660.6	0.0	688.3	4,269.8	4,504.1	4,395.3	4,493.3	3,883.0	2,066.6
69	VR	HVR2	VR21	20,144.3	1,772.1	1,610.8	1,289.1	1,833.6	1,439.0	1,526.3	1,785.6	1,510.1	1,952.3	1,987.7	1,614.6	1,603.1
70	VR	HVR2	VR23	26,868.7	2,520.7	2,012.5	811.0	2,682.2	2,064.0	1,827.6	2,364.3	2,440.9	2,459.6	2,454.7	2,518.1	2,713.1
Subtotal >>		HVR2		47,013.0	4,292.8	3,623.3	2,100.1	4,515.8	3,523.1	3,353.8	4,150.0	3,951.0	4,411.9	4,442.4	4,332.7	4,316.2
71	VR	HVR3	VR31	19,675.8	1,328.7	1,321.1	1,542.2	1,737.9	1,890.5	1,968.1	1,764.9	1,522.9	1,707.6	1,559.5	1,716.3	1,616.0
72	VR	HVR3	VR32	17,352.2	1,608.9	1,160.5	1,202.9	1,641.8	1,765.6	1,286.0	1,849.2	1,157.5	1,207.3	1,712.7	1,591.1	1,168.8
73	VR	HVR3	VR33	8,599.6	955.0	307.6	1,101.4	1,183.9	958.4	261.8	1,047.7	195.5	957.9	761.3	772.3	96.7
74	VR	HVR3	VR34	30,708.7	2,349.0	2,902.6	2,425.3	2,053.2	2,508.5	2,383.7	2,532.0	2,715.4	2,619.1	2,670.8	2,646.5	2,902.6
Subtotal >>		HVR3		76,336.3	6,241.6	5,691.9	6,271.7	6,616.8	7,123.0	5,899.7	7,193.9	5,591.2	6,491.8	6,704.3	6,726.2	5,784.2
75	VT	HVT1	VT11	30,855.6	2,397.8	2,693.4	2,559.1	2,617.9	2,618.2	2,297.2	2,521.1	2,687.9	2,600.0	2,581.9	2,573.5	2,707.7
76	VT	HVT1	VT12	17,365.4	1,391.1	1,614.7	1,400.5	1,444.8	1,329.6	1,299.7	1,558.3	1,464.0	1,338.6	1,633.1	1,438.4	1,452.6
77	VT	HVT1	VT14	27,033.4	1,642.7	2,482.3	2,323.3	2,357.5	1,714.8	2,212.5	2,217.8	2,377.8	2,458.0	2,367.2	2,434.9	2,444.5
Subtotal >>		HVT1		75,254.4	5,431.6	6,790.4	6,282.9	6,420.3	5,662.6	5,809.4	6,297.1	6,529.7	6,396.5	6,582.2	6,446.8	6,604.9
78	VT	HVT2	VT20	32,089.7	1,894.7	2,825.2	2,692.7	2,748.9	2,561.9	2,435.3	2,760.0	2,716.6	2,775.5	2,903.8	2,765.6	3,009.4
79	VT	HVT2	VT21	22,655.6	1,750.2	1,911.0	1,848.7	2,016.9	1,895.8	1,879.0	1,850.7	2,014.3	1,732.3	1,988.0	2,034.6	1,734.2
80	VT	HVT2	VT22	33,057.2	837.5	2,983.3	2,883.9	2,983.3	2,983.3	2,685.0	2,983.3	2,883.9	2,983.3	2,883.9	2,983.3	2,983.3
Subtotal >>		HVT2		87,802.6	4,482.5	7,719.5	7,425.2	7,749.1	7,441.0	6,999.3	7,594.0	7,614.8	7,491.1	7,775.7	7,783.5	7,726.9
Total >>				1,216,675.6	90,383.6	104,728.0	99,624.6	99,825.3	92,697.1	87,876.2	109,241.5	101,822.0	106,580.7	106,703.7	110,309.9	104,882.9



Success Criteria

- IPO creates a production schedule
 - IPO automatically sends a notification that a production schedule is complete to identified stakeholders via email with a link to access the production schedule in the email
 - IPO creates a production schedule that accommodates the marketing changes and Power BI displays show the comparative impact of the change request(s) to pre-identified performance and profitability KPIs to demonstrate support for schedule acceptance decisions.
 - IPO sends a notification to identified stakeholders that the new schedule based on change requests has been created with a request for review and/or approval.
- The dashboard shown is for illustration purposes. For the PoV, the dashboards will reflect the requirements of the customer.

Inventory Balance & Demand Fulfillment

Ubicación	Concepto	GLOBAL	SEP-14	OCT-14	NOV-14	DEC-14	JAN-15	FEB-15	MAR-15	APR-15	MAY-15	JUN-15	JUL-15	AUG-15
1	VR Inventario Inicial ST	1,166.5	1,166.5	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3
2	VR Inventario Inicial PT	9,307.6	9,307.6	14,207.2	12,683.8	12,941.2	14,977.4	14,723.1	12,115.6	13,335.2	14,745.8	16,578.2	18,668.7	18,325.3
3	VR Otros Inventarios	2,809.9	2,809.9	2,809.9	2,809.9	2,809.9	2,809.9	2,809.9	2,809.9	2,809.9	2,809.9	2,809.9	2,809.9	2,809.9
4	VR Inventario Inicial Total	13,284.0	13,284.0	17,035.3	15,512.0	15,769.3	17,805.5	17,551.2	14,943.7	16,163.3	17,573.9	19,406.3	21,496.9	21,153.4
5	VR + Producción ST	197,962.4	18,661.6	16,931.6	16,660.9	15,897.1	1							
6	VR (Producción PT) *	197,747.1	19,672.6	16,841.3	16,557.2	15,782.0	1							
7	VR + Outsourcing	0.0	0.0	0.0	0.0	0.0								
8	VR - Merma	1,363.5	137.2	90.3	103.7	115.1								
9	VR - Envios a Bodegas	0.0	0.0	0.0	0.0	0.0								
10	VR - Ventas	191,305.8	14,773.0	18,364.6	16,299.9	13,745.8	1							
11	VR = Inventario Final	18,577.0	17,035.3	15,512.0	15,769.3	17,805.5	1							



Periodos	SEP-14	OCT-14	NOV-14	DEC-14	JAN-15	FEB-15	MAR-15	APR-15	MAY-15	JUN-15	JUL-15	AUG-15
Producción [5,658]	398	478	446	439	463	437	514	473	511	497	531	471
Ventas [5,622]	455	497	458	402	443	456	479	450	487	491	496	508
Inventario Final	278	254	238	270	285	260	290	313	301	301	280	280

5	21 - AMBAR VIDRIO FUNDIDO	97.47	6.73	88,111.1	9,037.7	10,978.3	9,814.0
6	31 - AZUL SKY VIDRIO FUNDIDO	94.74	0.90	9,140.7	75.5	692.8	733.7
7	41 - VERDE GEORGIA VIDRIO FUNDIDO	98.31	11.89	161,079.9	15,973.6	14,242.7	13,125.9
8	51 - VERDE ESMERALDA VIDRIO FUNDIDO	100.00	1.82	22,783.7	2,273.0	2,336.7	2,239.4
9	C1 - VERDE ANTIGUO VIDRIO FUNDIDO	92.01	4.39	56,617.5	3,282.7	2,869.6	3,509.0
10	E1 - TRANSICION VIDRIO FUNDIDO	11.72	0.00	37.5	28.3	9.2	0.0
11	Q1 - VERDE CHAMPAGNE VIDRIO FUNDIDO	79.67	0.61	8,489.7	122.9	38.2	600.3
12	R1 - VERDE HOJA SECA VIDRIO FUNDIDO	91.67	1.04	15,461.1	50.1	1,747.9	689.2
To...		98.37	100.00	1,198,254.5	96,035.3	107,544.7	100,445.7

Solución: S-AJU-INV3-CDCM sf
 Escenario: EJ-ES merma

Estrategia: CD + CM
 Fecha: 17 Dec 2014 9:59:39 a.m.
 Horizonte: SEP-14 - AUG-15
 Filtros No Cobertura: 0

SERVICIO Demand Fulfillment

	TON	Miles PZAS	Miles MXN	%
Demanda	1,227,575	5,714,691		100.00
Ventas	1,198,255	5,621,628		98.37
No Cobertura	29,321	93,063		1.63

UTILIZACIÓN Resource Utilization

	Máquinas (Días)	Acabado (Días)	Hornos (TON)
Capacidad	25,530	43,821	1,696,155
Utilización	22,245	5,198	1,422,541
Utilización (%)	87.13	11.86	83.87

DISTRIBUCIÓN Distribution to warehouse (shipments)

	TON	Miles PZAS	Miles MXN	%
Plantas - Bodegas	0	0	0	0.00
A Clientes	1,198,255	5,621,628	6,826,450	100.00
Total	1,198,255	5,621,628	6,826,450	100.00

ANÁLISIS ECONÓMICO Economic Analysis

	Miles MXN	%
INGRESO		
- Costo Producción Liso		
- Costo Producción Acabado		
- Costo Outsourcing		
- Costo Distribución		
- Costo Financiero Inventario		
= CONTRIBUCIÓN MARGINAL		

INVENTARIO Inventory Balance

	Inicial	Final	Variación (%)
TON	78,461	78,942	0.61
Miles PZAS	368,885	308,379	-16.40
Días	22	18	-17.78

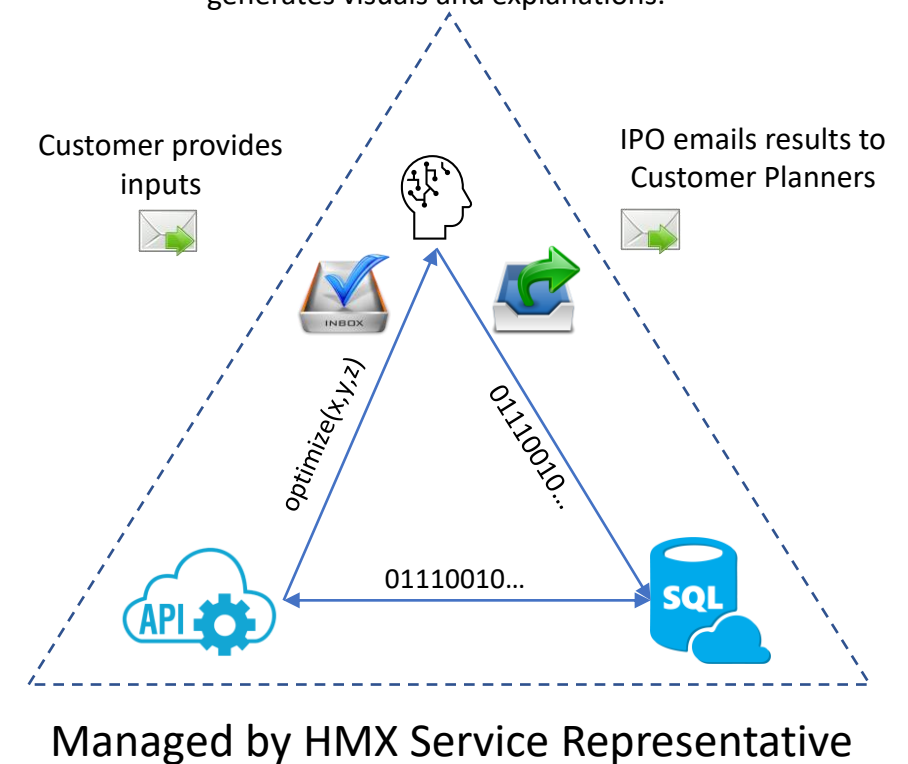
IPO Service Provision

- IPO is offered as an Azure solution, and as a service with an SLA.
- Customer does not require knowledge of IPO or Cognitive Map maintenance.
- HMX or HMX Partner maintains the IPO application according to Customer requirements.
- A dedicated service representative is assigned to each customer by HMX.
- Customer works with the service representative on a regular basis to meet changing needs.



Intelligent Production Optimization

IPO automatically retrieves results, analyzes results & generates visuals and explanations.



Proof of Value (PoV) Terms and Conditions

- For the PoV, we estimate the total cost to be \$70k-\$80k.
 - This is a maximum cost.
- Terms for PoV:
 - 25% of PoV cost due on signature of letter of agreement
 - 25% of PoV due on delivery of the PoV application
 - Remaining 50% will depend on the outcome of the PoV