Advanced Analytics & Business Consultancy

SOGRAPE
ORIGINAL LEGACY WINES

Designing a new production facility for a FMCG producer using a simulation model

AnyLogic Conference 2024

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LTP is a boutique analytical-driven management consultancy

Who we are

A **proven data-driven approach** enables LTP to address the complex challenges faced by its clients.

LTP combines **advanced analytics with business expertise** to deliver significant and sustainable impact in **bottom line profitability**.

50+ consultants

200+ projects

10+ countries

>25% annual growth[1]

1 Annual growth rates always above 25% in the past 5 years

LTP has a wealth of experience in facing crucial business challenges with the same data-driven mindset

Our scope of action

NON-EXHAUSTIVE

Marketing & Sales

Growth

Market & demand
How to anticipate sales trends?

Pricing & promotions
When and how to change prices?

Targeted marketing & customer insights
What is the next best offer for each client?

Footprint & assortment & profitability
Where to open the next store? Which products to sell?

Supply Chain & Operations

Efficiency

Network design
What is the ideal supply chain configuration?

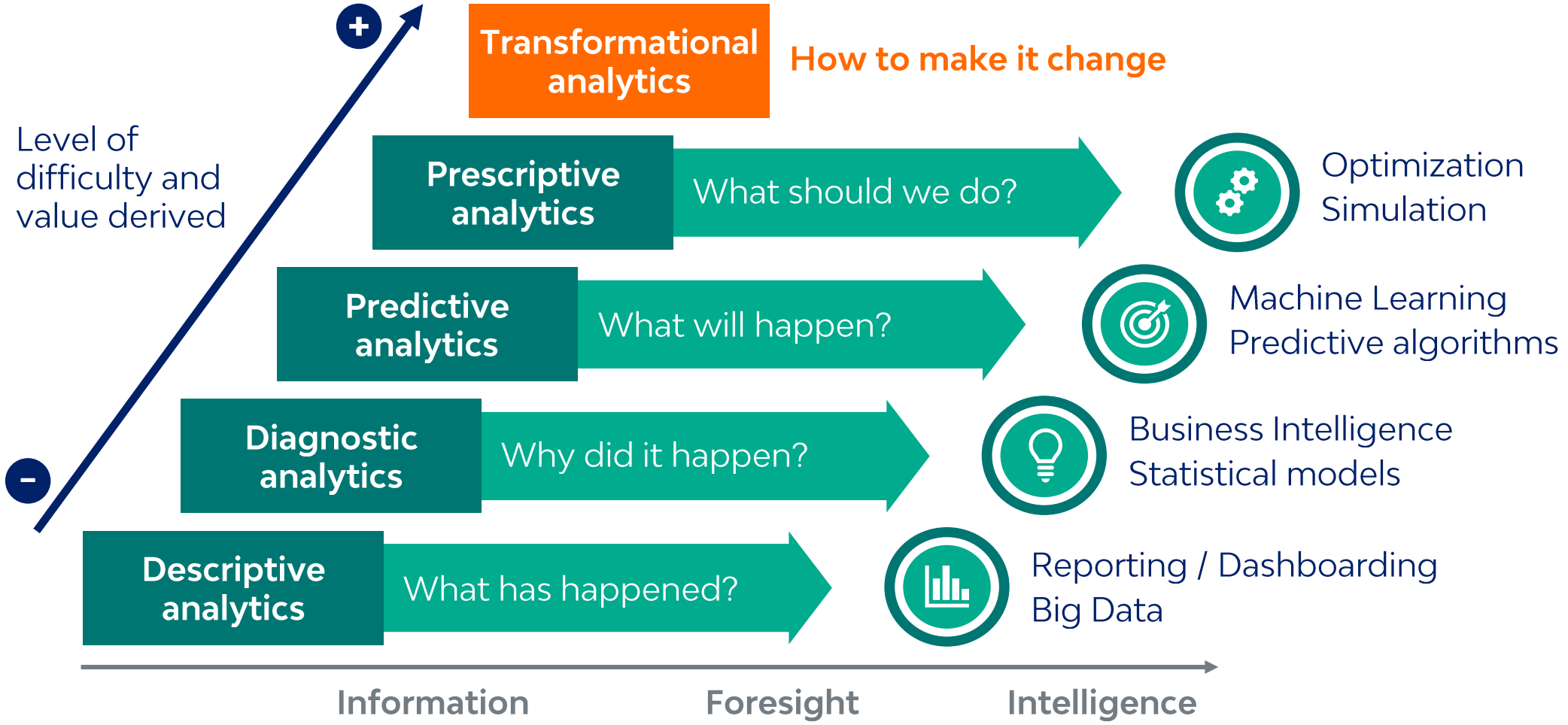
Production strategy
When and where to produce each lot (MTS vs. MTO)?

Supply chain & inventory
How to coordinate inventory with product flows?

Capacity & workforce
How to balance and optimize resource allocation?

LTP's work in business analytics may be categorized in five axes: from information-driven to optimization-driven

The business analytics journey



The project was carried out at Sogrape, the leading wine company in Portugal

Sogrape presentation[1]

333M€
Turnover

> 1.200
Employees

> 120
Markets

> 500
Agency brands

> 35
Own brands

50M
Liters of vinification capacity

The centralization of operations is an opportunity for the modernization that the competitive context demands

Sograpе's challenges

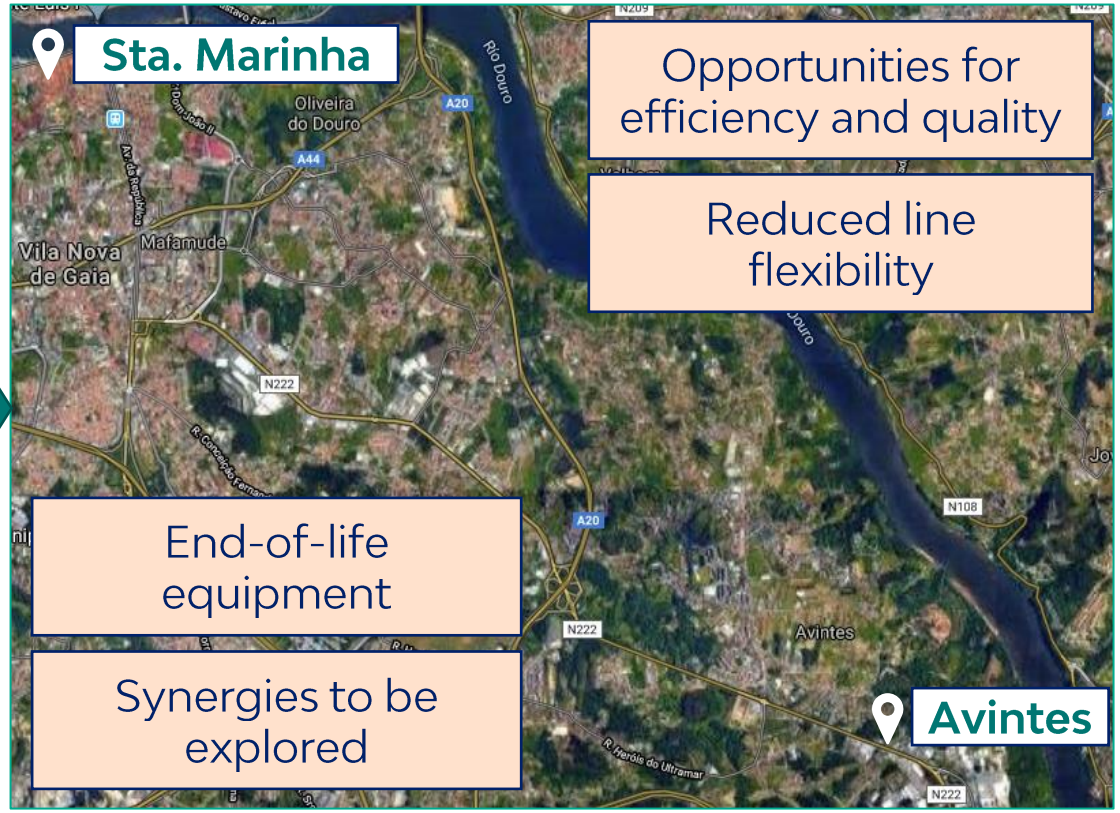
External factors

- **Proliferation of niches**
- **Growing importance of innovation**
- **Pressure on high volume margins**
- **Digitalization as a promoter of competitiveness**

Opportunity to **centralize** production centers in Avintes, addressing the need to **modernize** operations

Opportunity to get closer to **Industry 4.0**, through **digitalization** of the shop floor, **data integration**, **automation** and **robotization**

Sograpе's situation



The project aims to identify the ideal layout for the future production center, considering future needs

Challenges

Challenges

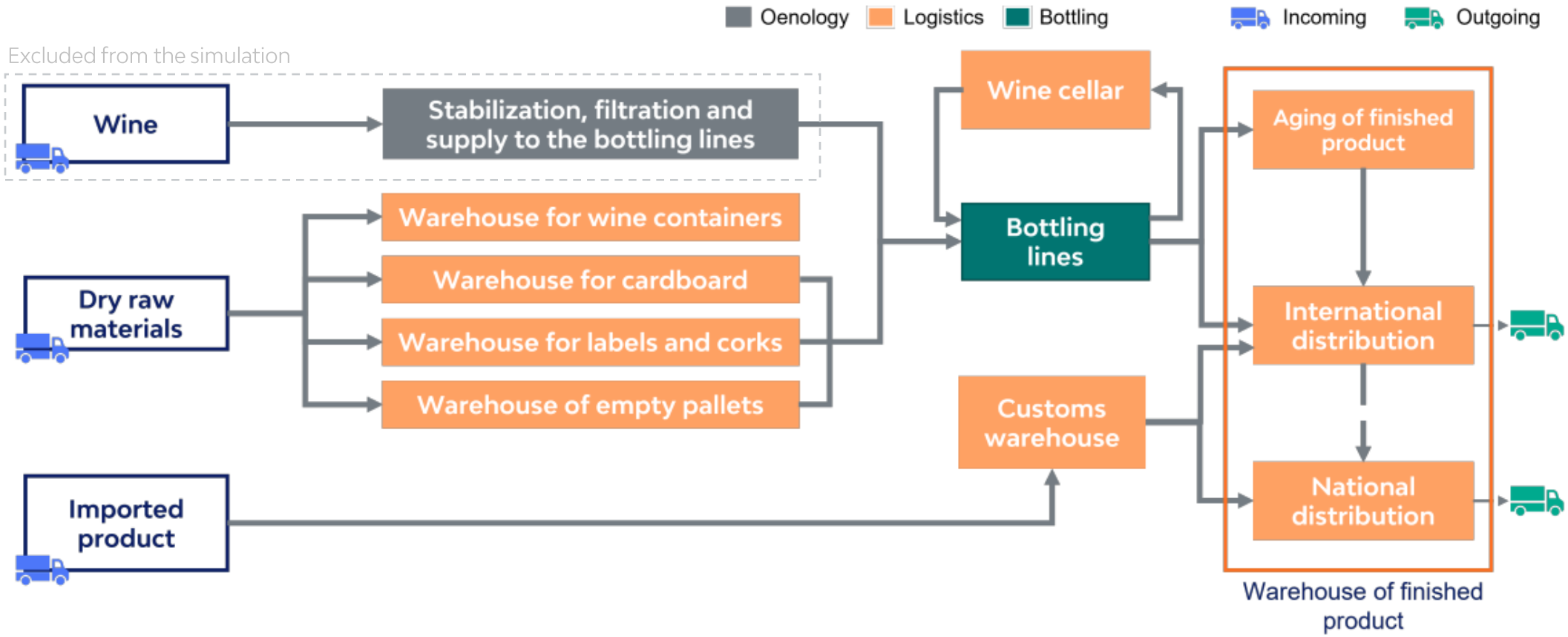
- Ensure **area requirements** for each activity, machine, or warehouse, as well as smooth and optimized **flows** within the facility
- **Uncertainty regarding future demand** and, consequently, the space and resources needed
- Unable to **test** and **compare different layouts** in real life

Goals

- Identify the **ideal macro-layout** to meet the needs of the company's growth
- Identify the **resources needed** for the future operations

Designing a new production facility requires understanding of the various operations in the production center

Sograpе's Operations



Considering the different processes involved, several areas must be considered in the simulation

Solution approach – simulation requirements

What areas[1] should be analyzed to simulate to cover all the processes in a wine production company?

Bottling	• Production lines • Forklift park • Support área (e.g.: waste storage)
Warehouses	• Raw-material warehouse (except glass) • Glass warehuse • Semi-finished products • Finished products • Empty pallets
Reception and dispatch	• Docks for recpetion of raw-material • Docks for reception of glass • Reception area • Docks for order shipping • Picking area • Order preparation area

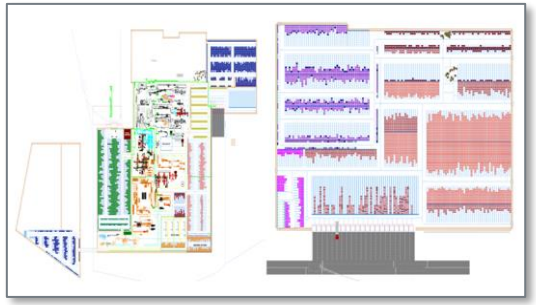
1 Areas dedicated to oenology, maintenance and quality control were not considered, as they do not interfere with the flows and other processes in the main area of the factory

Four layouts were defined and designed for the simulation, allowing to compare different configurations

Solution approach - layouts simulated

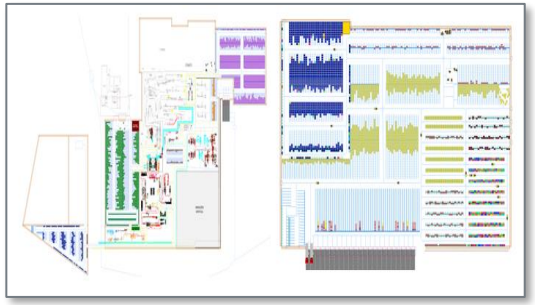
Layout #1

- **Reception** and **storage** of **raw material** and **semi-finished product** on the **upper floor**
- **Storage** and **shipping** of finished product on the **lower floor**



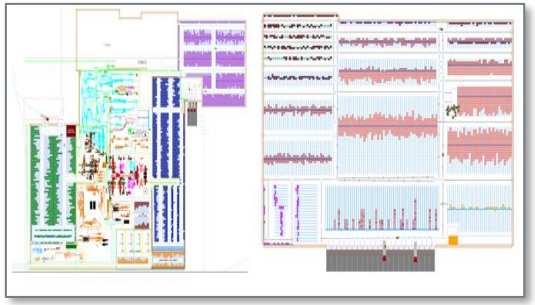
Layout #2

- **Storage** and **shipping** of of the **finished product** in the **upper** and **lower floor**
- Reception of **raw materials** in the **upper floor** and **storage** in both **upper and lower floor**
- **Storage** of **semi-finished product** in the **lower floor**



Layout #3

- **Storage** of **finished product** in a **vertical warehouse** and **lower floor** and **shipping** in **lower floor**
- Organization of **production lines** in a **central** space
- Reception of **raw materials** in the **upper floor** and **storage** in both **upper and lower floor**



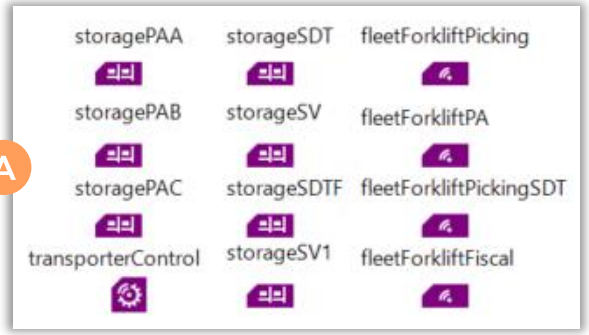
Layout #4

- Similar as **Scenario #1,** considering the **outsourcing** of part of the operation

The model incorporated different simulation techniques in order to accurately describe the real system

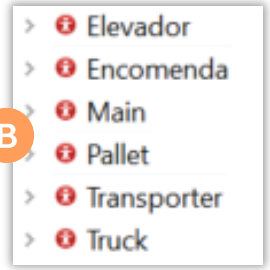
Simulation approach – model componentes (1/2)

A



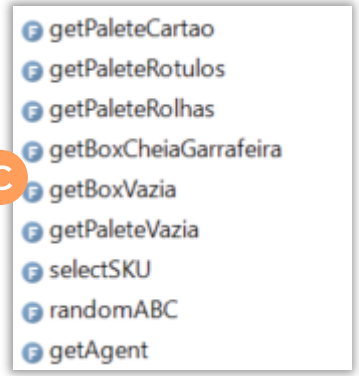
Storage Systems & Transporter Fleet, which can vary between runs and scenarios

B



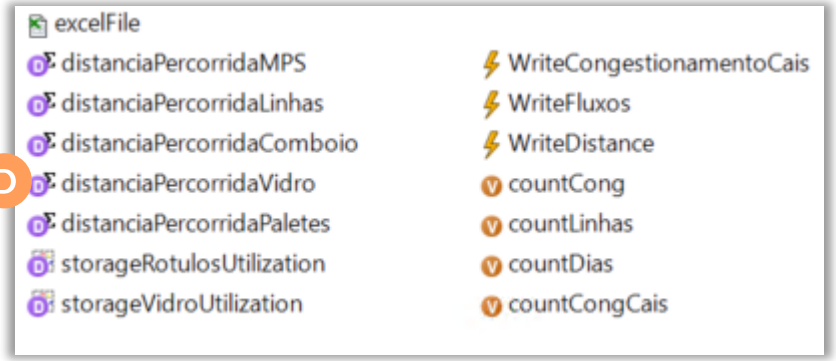
Agent-based simulation, to control and change the characteristics of the main elements

C



Java functions to provide **flexibility** required to **accurately depict** the full real process

D



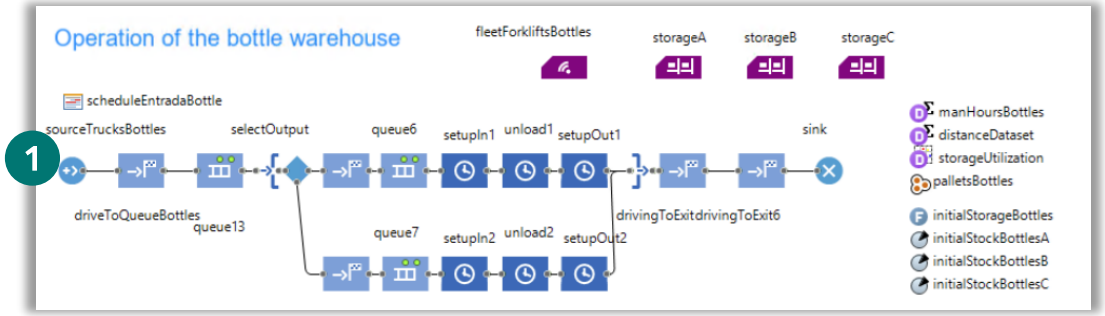
Variables, Data sets and **events**, to collect KPIs for the different processes and write them in an Excel File throughout the simulation

Note: The simulation was run for the moth that requires more activity, and consequently, resources and space

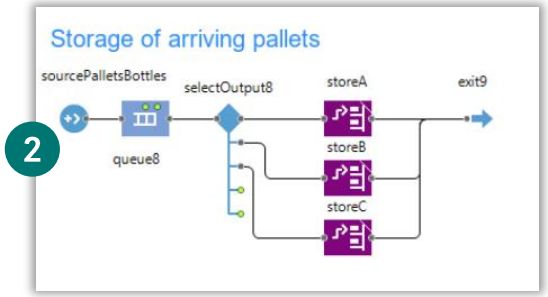
The model incorporated different simulation techniques in order to accurately describe the real system

Simulation approach – model componentes (2/2)

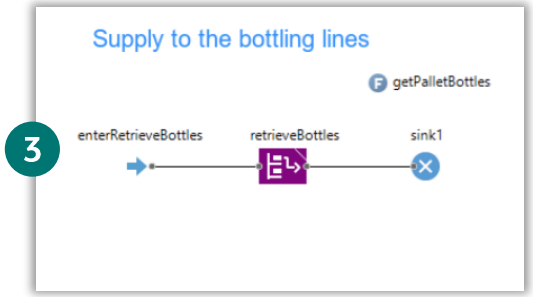
Different flows to recreate the processes involved:



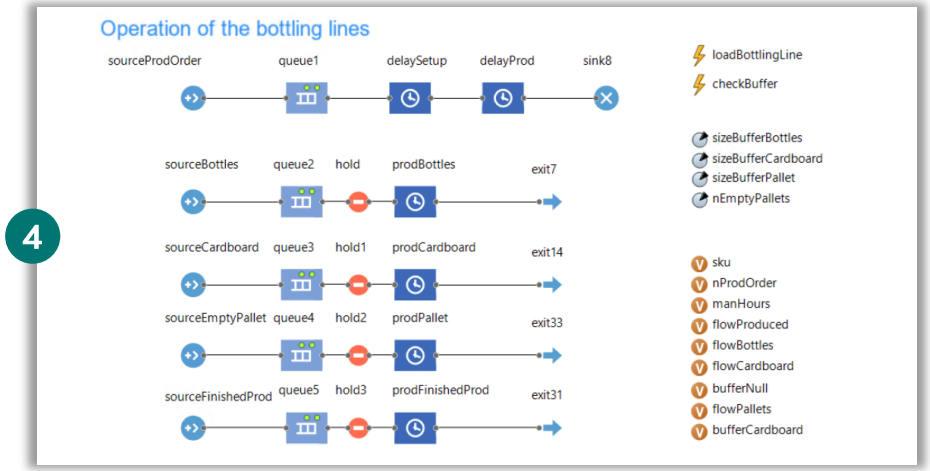
Arrival and dispatch of trucks



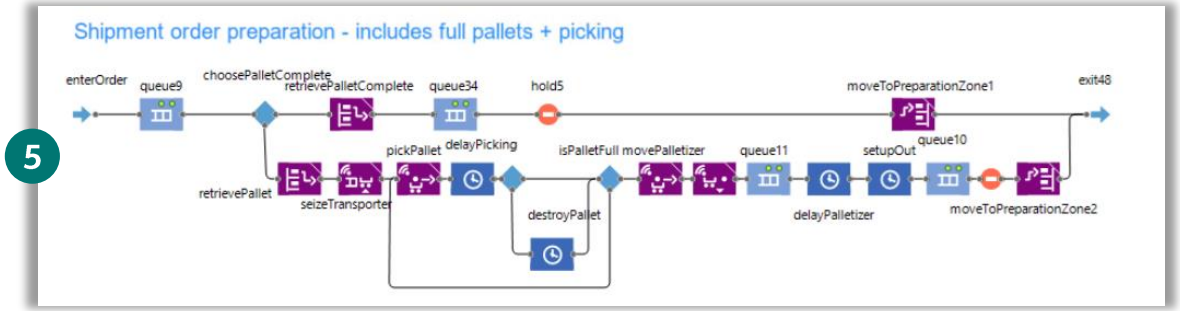
Storage of the different products



Picking and supply of production lines



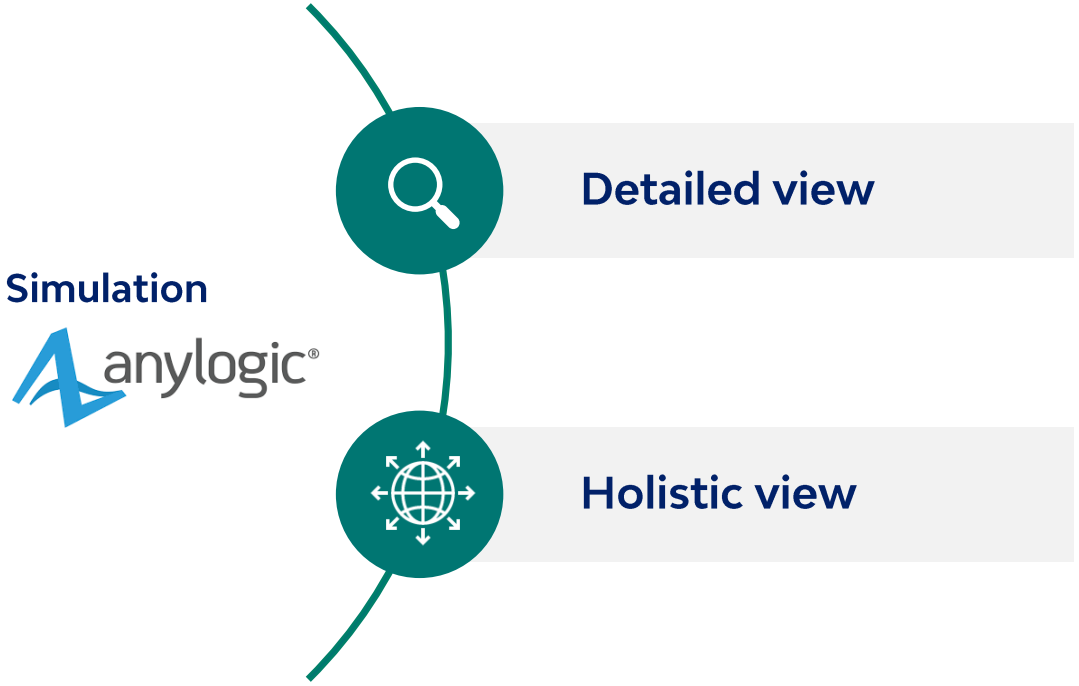
Production of semi-finished and finished products



Picking and order preparation for delivery

Simulation arises as a decision support methodology in multiple business areas

Solution approach - simulation



Features

- Allows to **foresse KPIs**
- Enables **scenario testing** in the simulated system
- Confers **great flexibility** to the solution's development
- Allows to **test**, in virtual environment, layout **configurations that do not exist**

Simulation comes up as a methodology with high potential to **provide a support to the decision-making** regarding the facility layout

The simulation model allows to simulate Sograpeʼs operation and evaluate the performance of each layout

Solution approach – simulation model

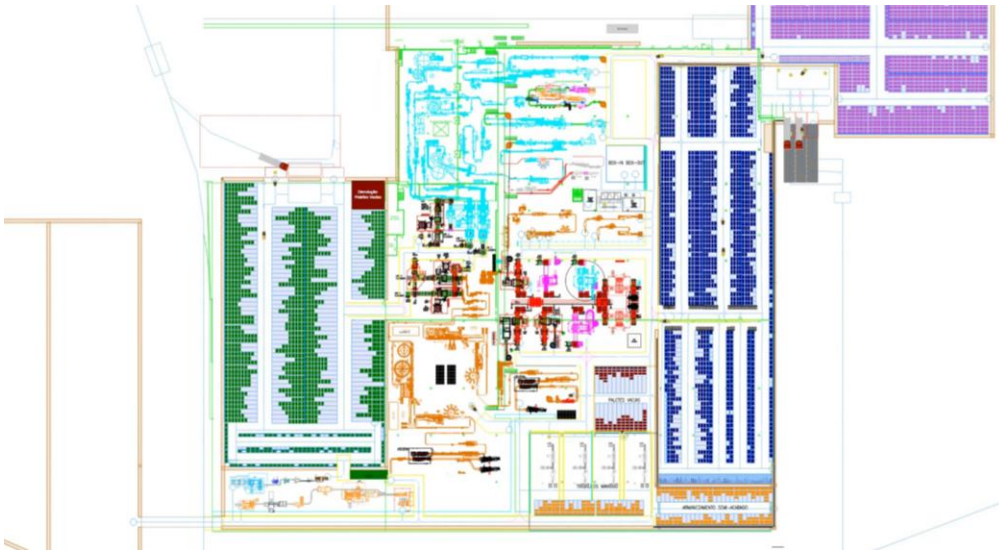
Parameters associated with the future operation

- Demand forecast
- Facility areas
- Production lines
- Production capacity required
- Storage equipments

Parameters associated with facility resources

- Historical data on productivity and order picking
- Load and unload time per pallet
- Production time
- Number and average speed of forklifts
- Number of docks
- Truck entry/exit flows and times

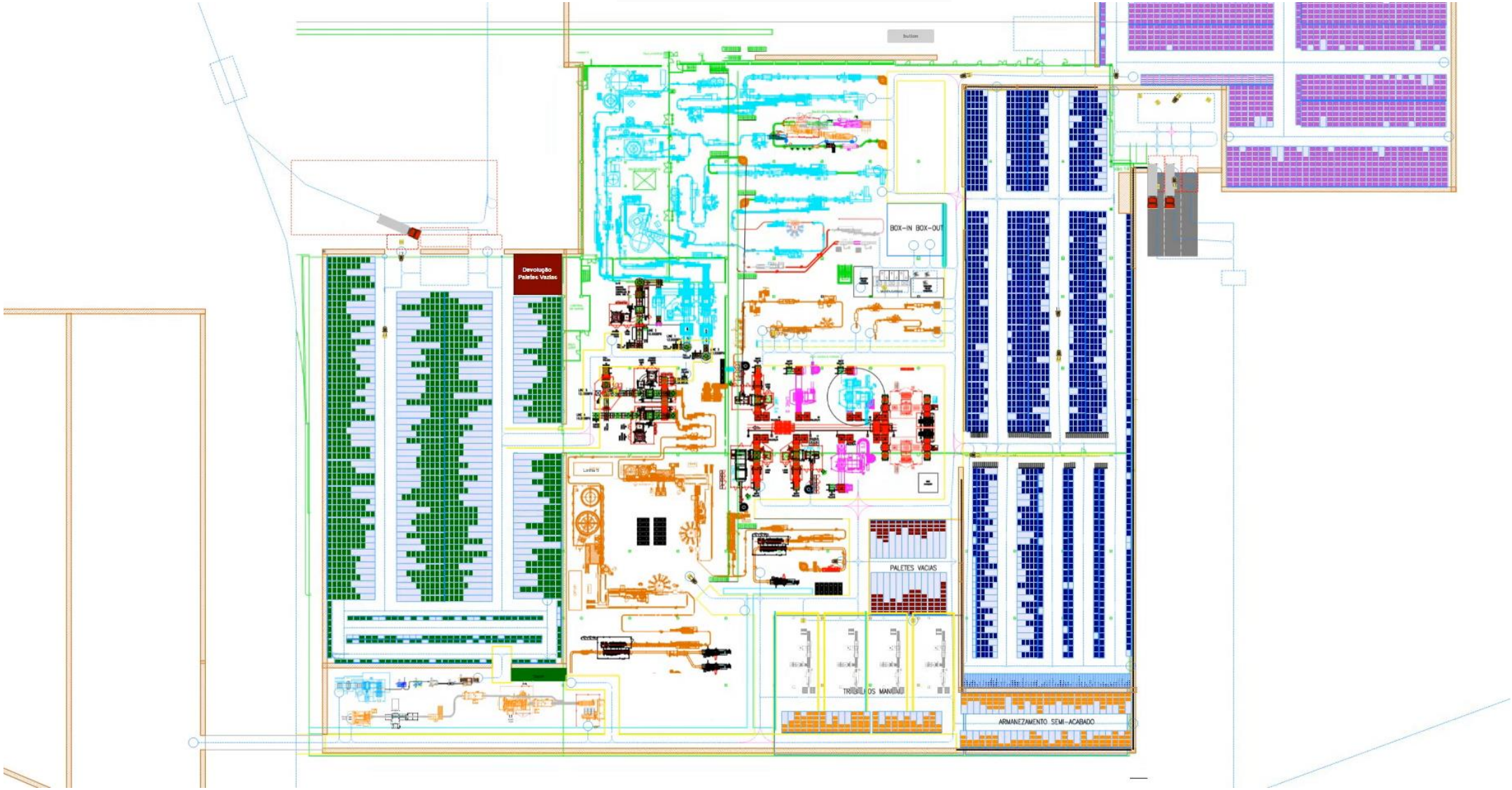
AnyLogic Simulator



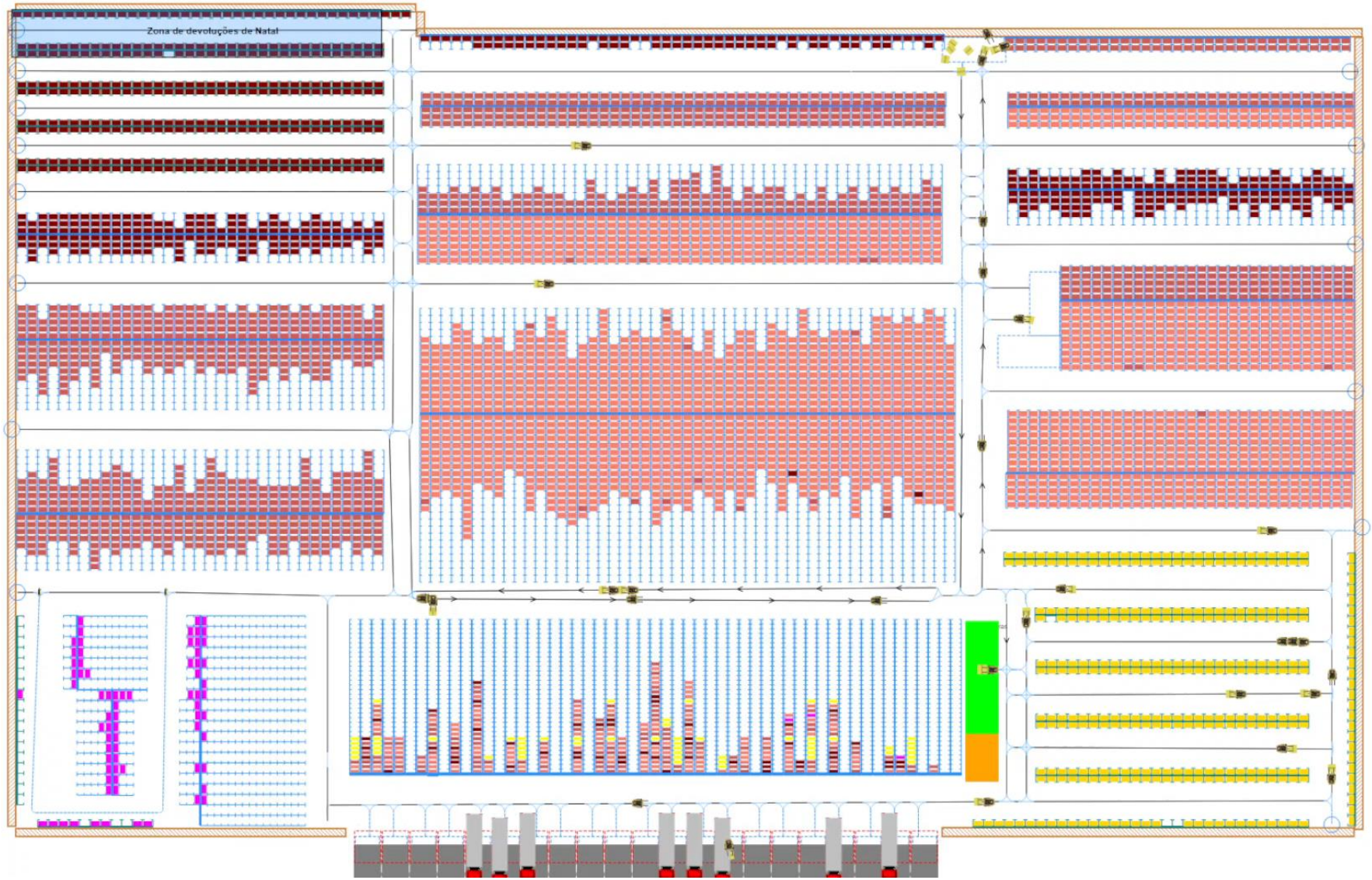
KPIs

- Congestion at critical points points
- Resource utilization
- Number of movements and distance traveled
- Trucks' loading/ unloading times
- Productivity

L1: Upper Floor
Simulation



L1: Lower Floor
Simulation

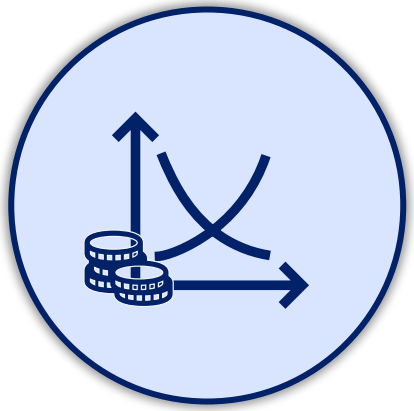


The results' presentation encompasses three distinct stages

Results

Insights retrieved

Key results



Cost evolution

The simulation model developed enabled the retrieval of valuable insights for the business at hands

Insights retrieved

Layout potential

Allowed to understand **the impact of new potential layout** designs **before their existence/contruction**

Warehouse occupation

Allowed to obtain the **expected wharehouse occupation,** accoring to **storage solutions** and considering the **specificities** of each **material/product**

Scenario exploration

Set up the grounds for the study of **unexplored options regarding new layouts and technological solutions**, including combined scenarios (layouts) testing

Facility's operation

Empowered the company with a tool to **estimate indicators** related to the **performance of the production center** (e.g., productivity, loading and unloading time of the trucks)

Resources capacity

Facilitated understanding of the **number of resources needed** to achieve the expected productivity of the processes involved (e.g., forklifts, docks, man-hours required)

Congestion analysis

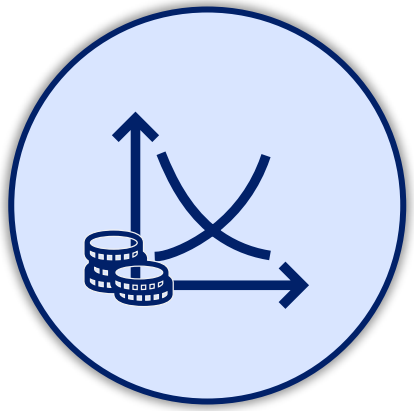
Enabled to **identify critical points** in the facility, with higher **probability of interception o**f the means of movement

The results' presentation encompasses three distinct stages

Results

Insights retrieved

Key results

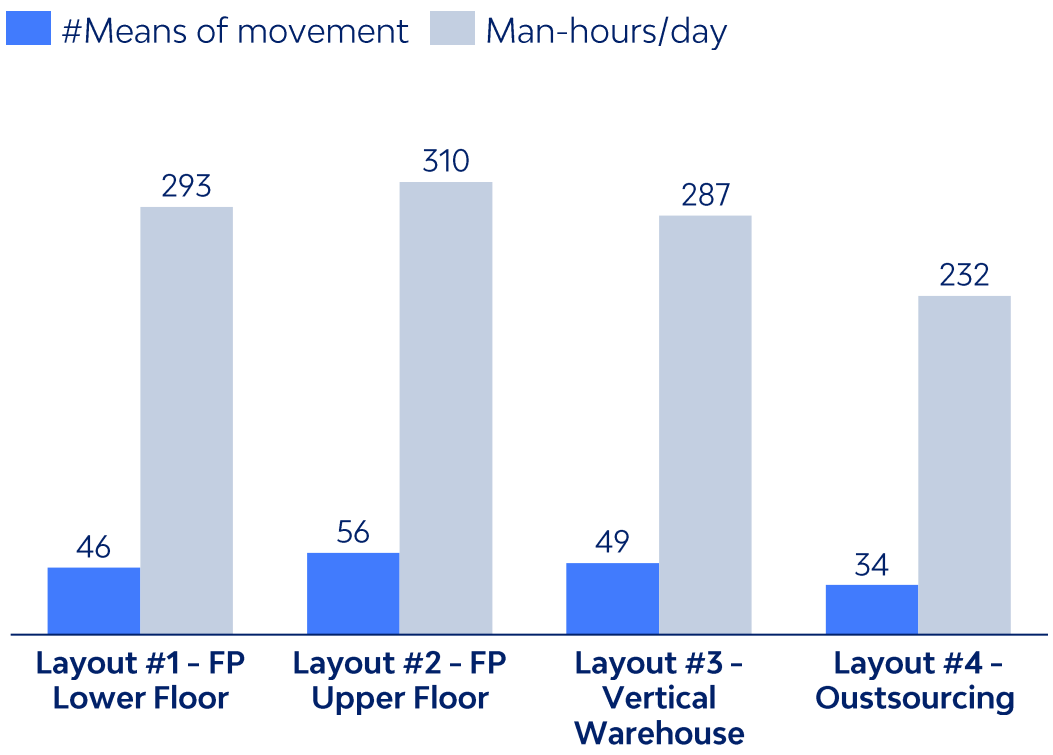


Cost evolution

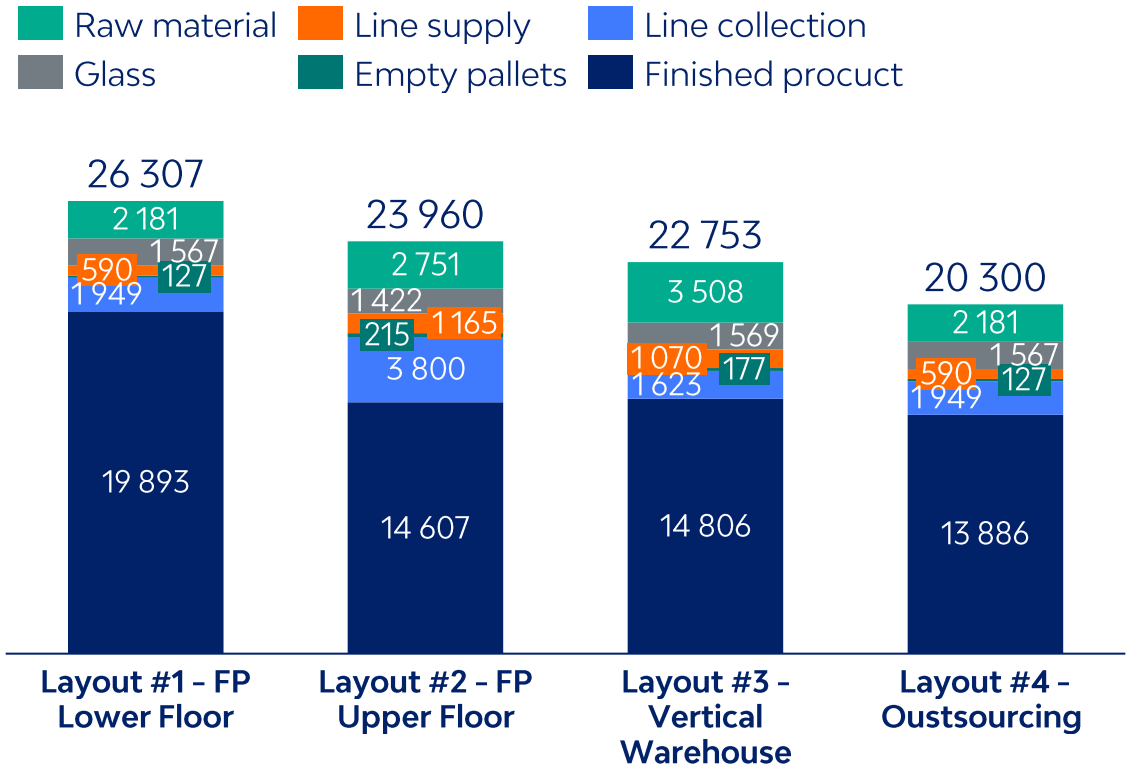
Layout #2 requires a greater number of man-hours/day to ensure operations, Layout #1 proves to be the most efficient

Key results (1/4)

Means of movements - Global Results



Distance travelled (km)



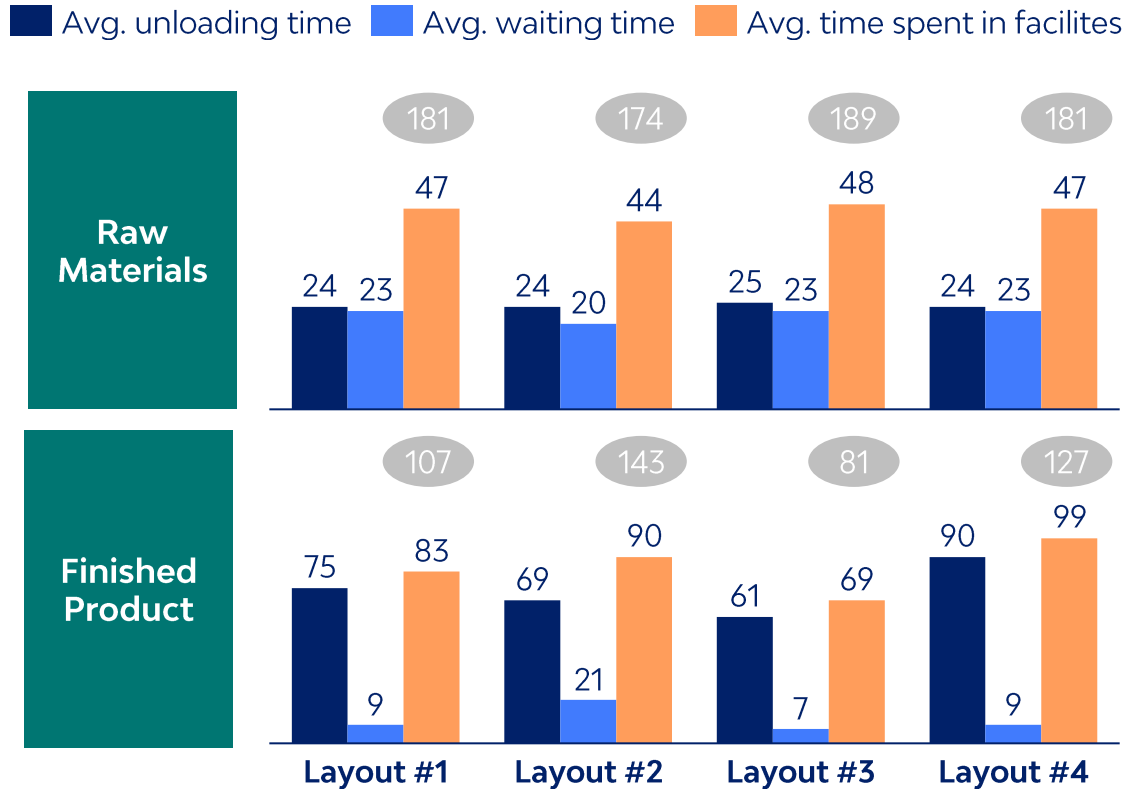
Layout #2 requires a greater number of man-hours/day to ensure operations, Layout #1 proves to be the most efficient

Key results (2/4)

Utilization Rate – Means of movement (%)

	Average utilization rate	Maximum utilization rate	#Means of movement
Layout #1	58%	88%	**46**
Layout #2	53%	87%	**56**
Layout #3	49%	83%	**49**
Layout #4	62%	93%	**34**

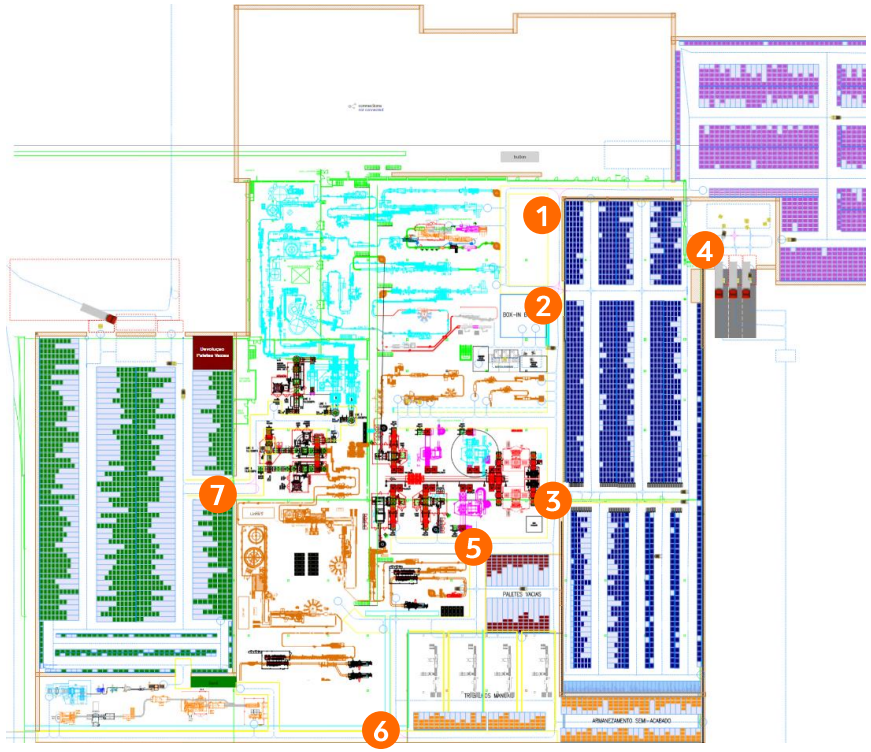
Trucks' Loading/Unloading Time (min.)



1 Layout #1 – FP Lower Floor; Layout #2 – FP Upper Floor; Layout #3 – Vertical Warehouse; Layout #4 - Outsourcing

To analyze and compare congestion in the different layouts, 7 critical points were identified

Key results (3/4)

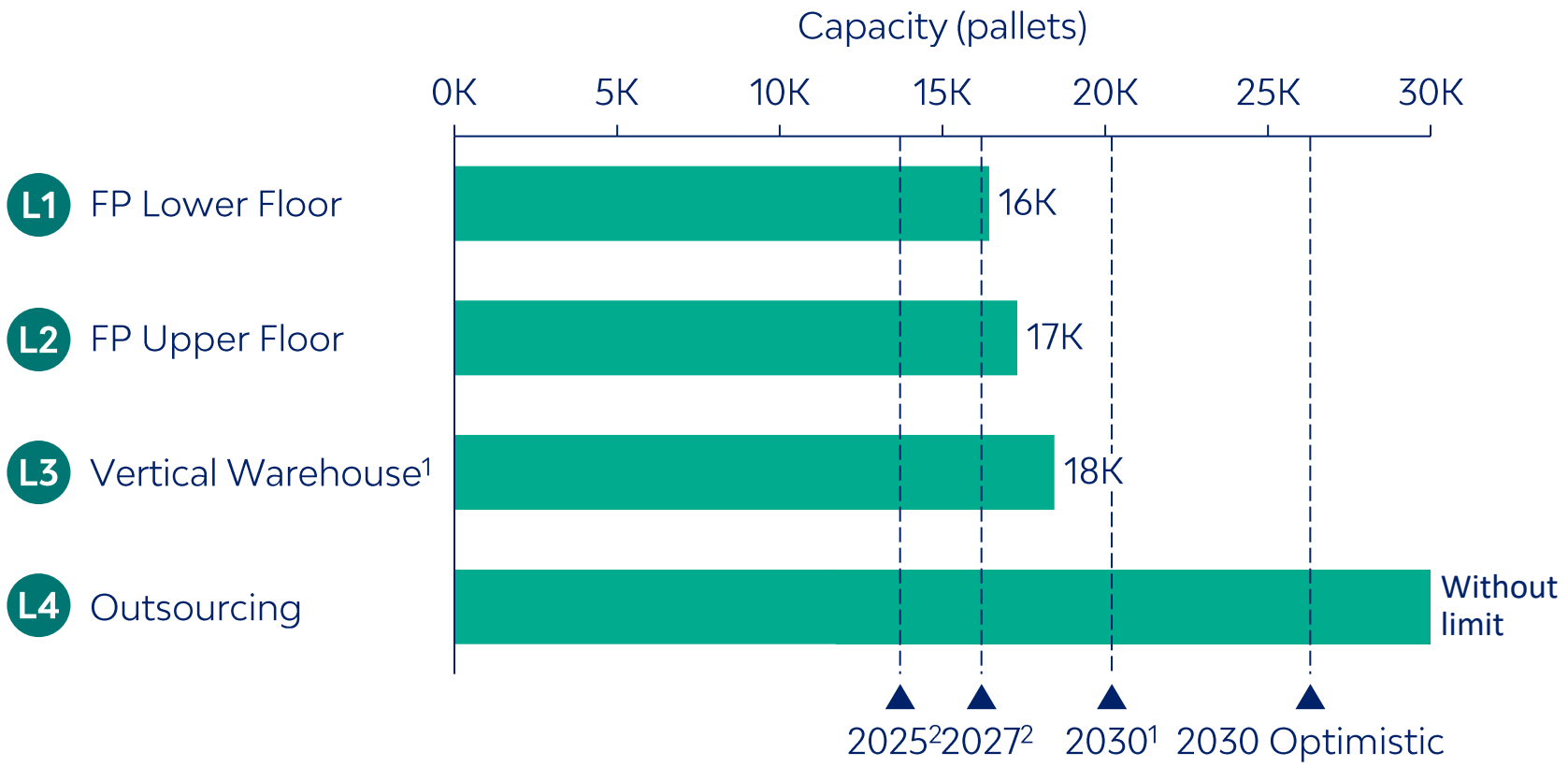


Local		L1 – FP Lower Floor L4 - Oustourcing		L2 – FP Upper Floor		L3 – Vertical Warehouse	
		#conflicts	#Passages/ hour	#conflicts	#Passages/ hour	#conflicts	#Passages/ hour
1	Semi-finished	481 (3.6%)	43	2 004 (6.7%)	99	542 (3.7%)	48
2	RM[1] Entrance1	1 870 (9.7%)	63	7 017 (13.5%)	170	2 027 (7.7%)	86
3	RM[1] Entrance2	516 (3.7%)	46	130 (3.8%)	11	130 (3.8%)	11
4	Docks	60 (1.9%)	11	2 345 (8.3%)	92	16 (1.4%)	4
5	Principal Corridor	172 (2.1%)	27	1 557 (6.4%)	80	186 (2.5%)	24
6	Final Corridor	14 (0.6%)	8	115 (2.0%)	19	212 (3.9%)	18
7	Glass Entrance	149 (1.5%)	32	178 (1.8%)	32	152 (1.6%)	32
TOTAL		3 262 (4.7%)	237	13 346 (8.7%)	503	3 265 (4.8%)	223

1 Raw material

The Layout #1, Layout #2 and Layout #3 will not have full finished product storage capacity by 2030

Key results (4/4)



- **None of the base layouts** (L1, L2, L3) can accommodate all the **stock in 2030** in the base scenario
- Comparatively, **external space requirements** are **lower** with the adoption of **vertical storage** (L3)
- Only the **outsourcing** of part of the operation (L4) allows an **activity compatible** with the **optimistic scenario of 2030**

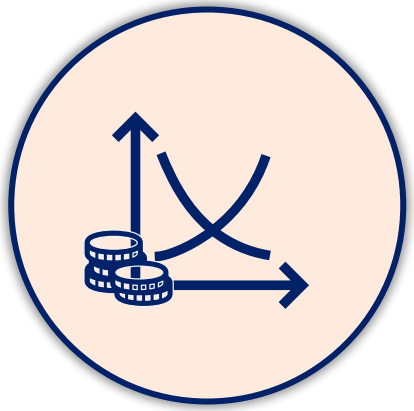
1 Base scenario

The results' presentation encompasses three distinct stages

Results

Insights retrieved

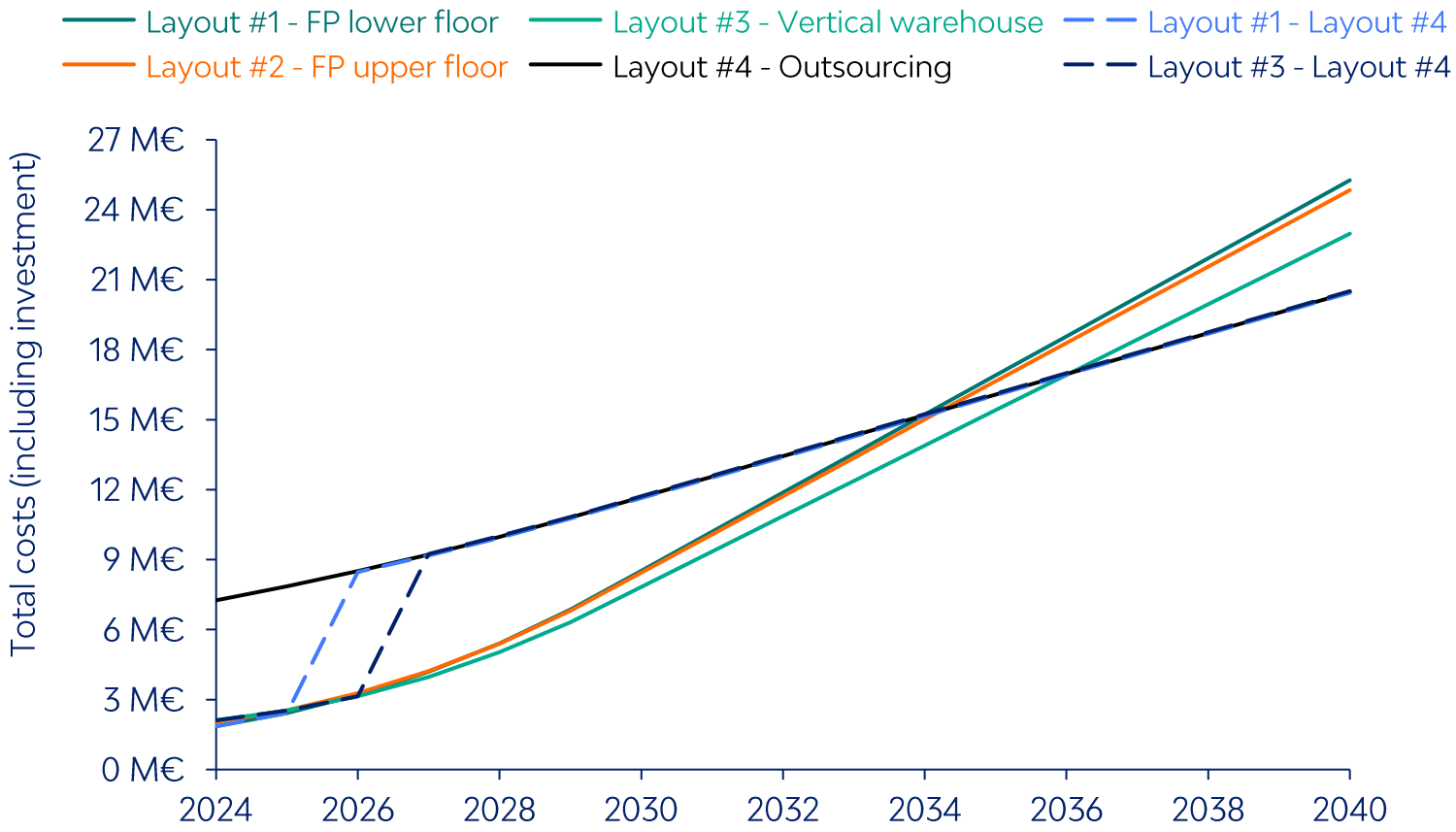
Key results



Cost evolution

In an optimistic scenario, adopting the Layout #1/#3 with a transition to Layout #4 (outsourcing) are the most advantageous options

Cost evolution - Optimistic scenario



- For the **optimistic demand scenario**, the **outsourcing** solution will ensure full **return on investment** between 2034 and 2036
- Given the **optimistic evolution** of demand until 2030, the **construction of a new warehouse** should take place between **2025-2027**
- The decision to **switch from L1 or L3 to L4** was based on the moment when the **operating cost** of the original scenario (L1 and L3) **exceeds the operating cost of the scenario with outsourcing** (L4)

Layout #2- Layout #4 scenario disregarded given the reduced interest in adopting the Layout #2

The work developed provided Sogrape with an analytical support regarding the design of a new production center

Conclusions

- Integrated view of **all factory operation** and **full comprehension** of each **process** involved
- The s**imulation-based** methodology confers **greater confidence and support** to the decision-making, being able to test multiple scenarios before **physical transformations**
- Ability to **test and evaluate different configurations** and transport solutions
- Identification of the ideal number of **resources** needed (e.g.: transporters)

Future work

- **Adaptation/updating** of the **results** obtained in the project during the refinement of the **technological solutions** to be acquired
- **Design** and **simulation** of **detailed layouts** for each **area** of the production center, with fine sizing of transportation resources (e.g. logistics train, forklift trucks)

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WITH ANALYTICS

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