



AUTOFAC

DIGITAL TWINS

The Future of Manufacturing

What is a Digital Twin?

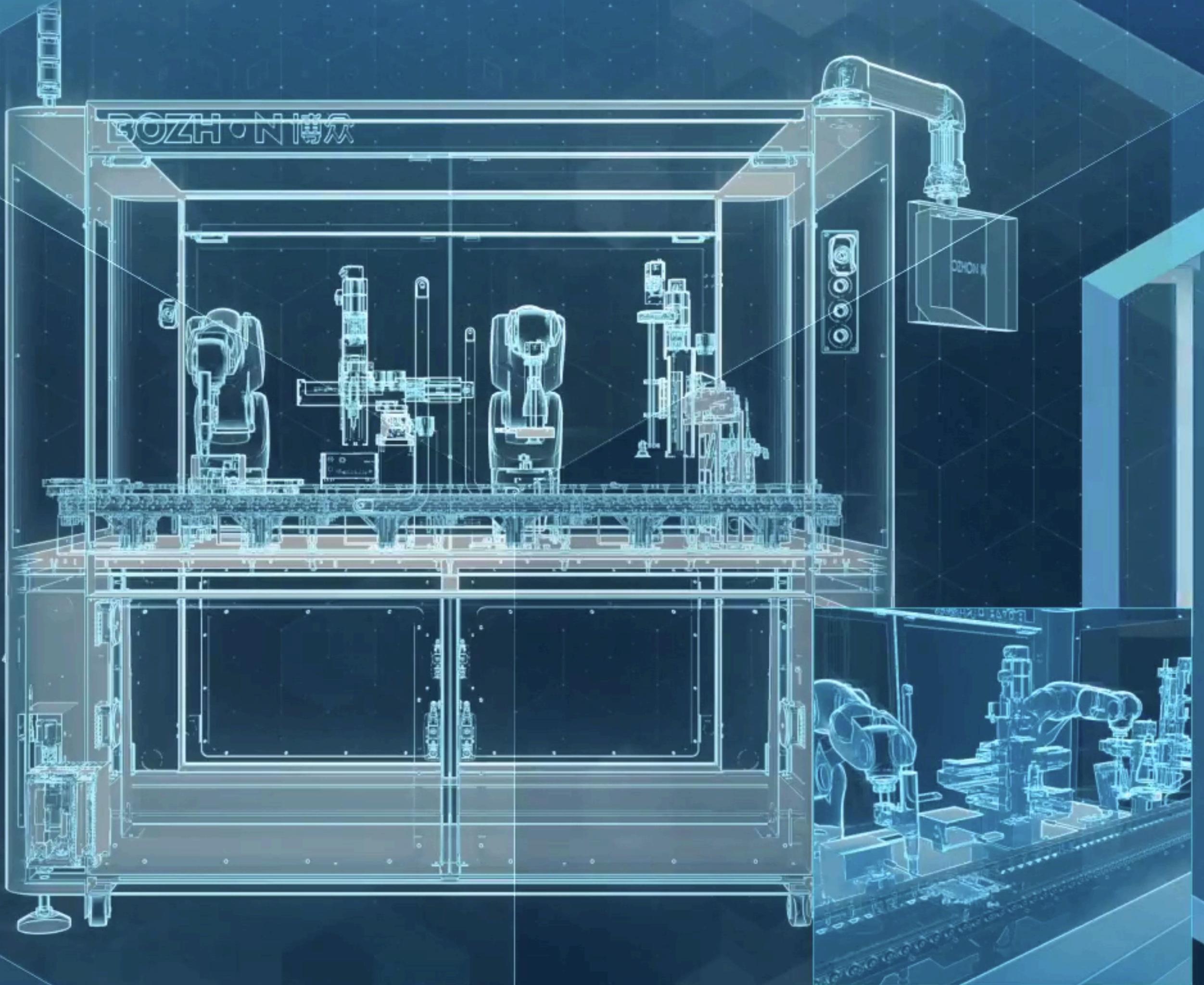
Physical Reality

synchronized with

Virtual Representation



Digital Twin



Real Machine



Our Mission

Your Factory, Your Control
Monitor – Predict – Optimize



Design Optimization

AI optimizes factory layout design, labor assignment, and equipment selection based your metric of interest.



Real-Time Monitoring

All activities and metrics are tracked in the digital twin,
and could be viewed in real-time.

Real-Time Prediction

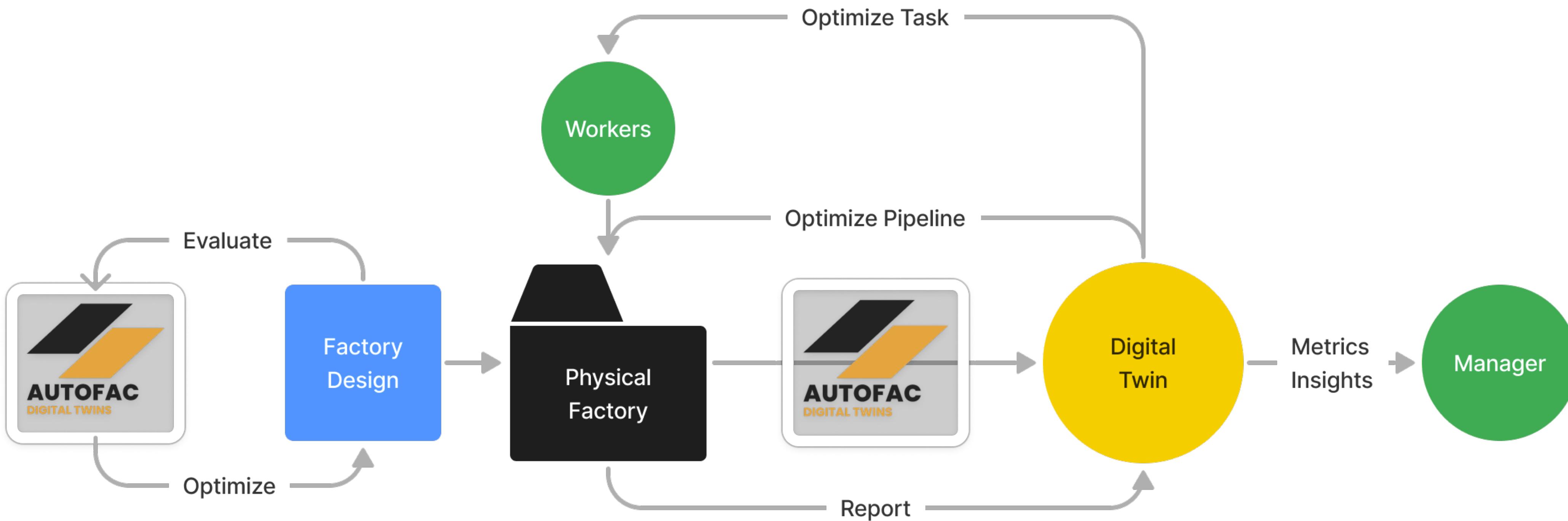
AI constantly learns from data,
and make future predictions of all metrics in real-time.



Real-Time Optimization

AI uses the digital twin to make predictions, evaluate changes, and make optimizations in real-time.

Workflow

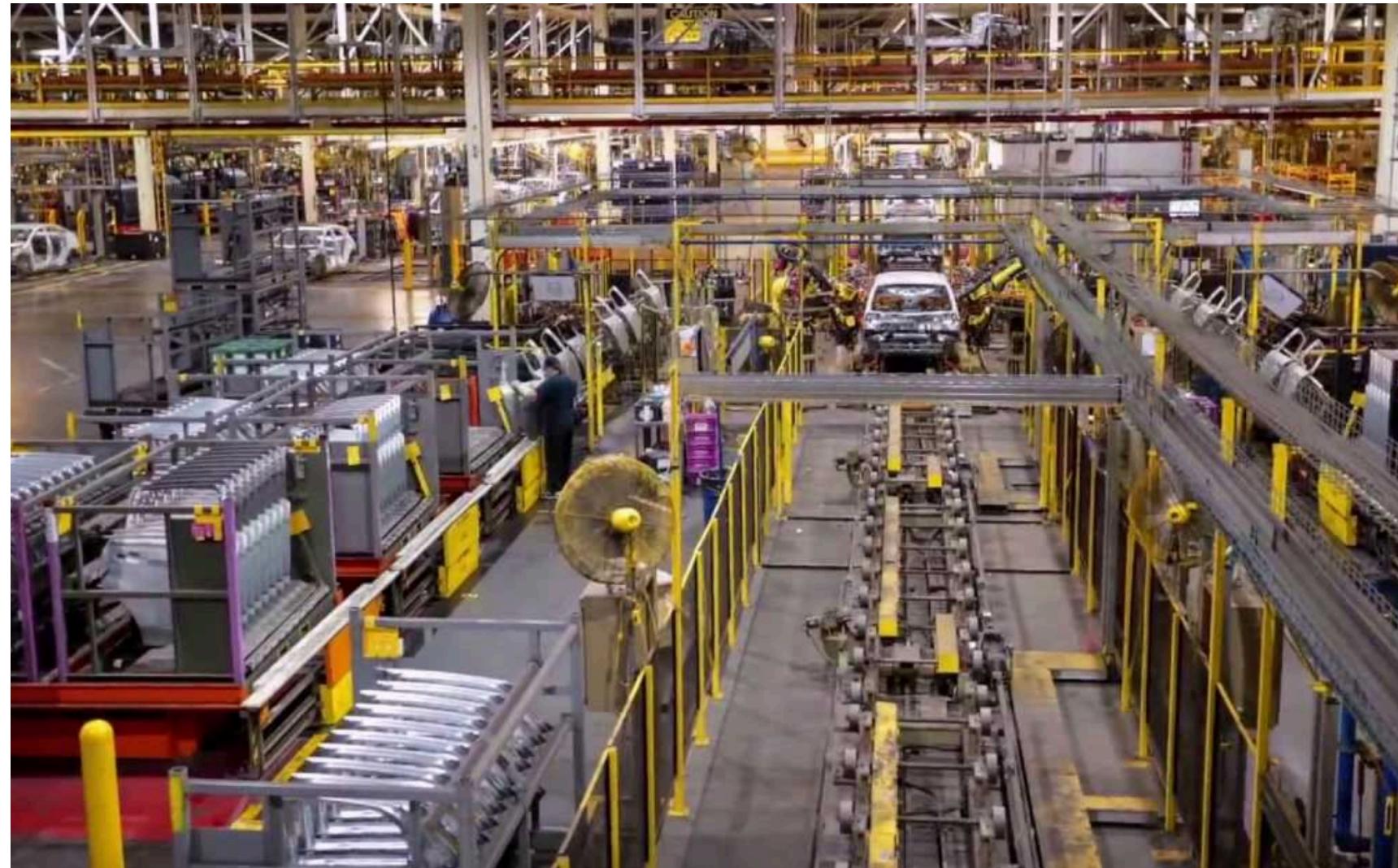




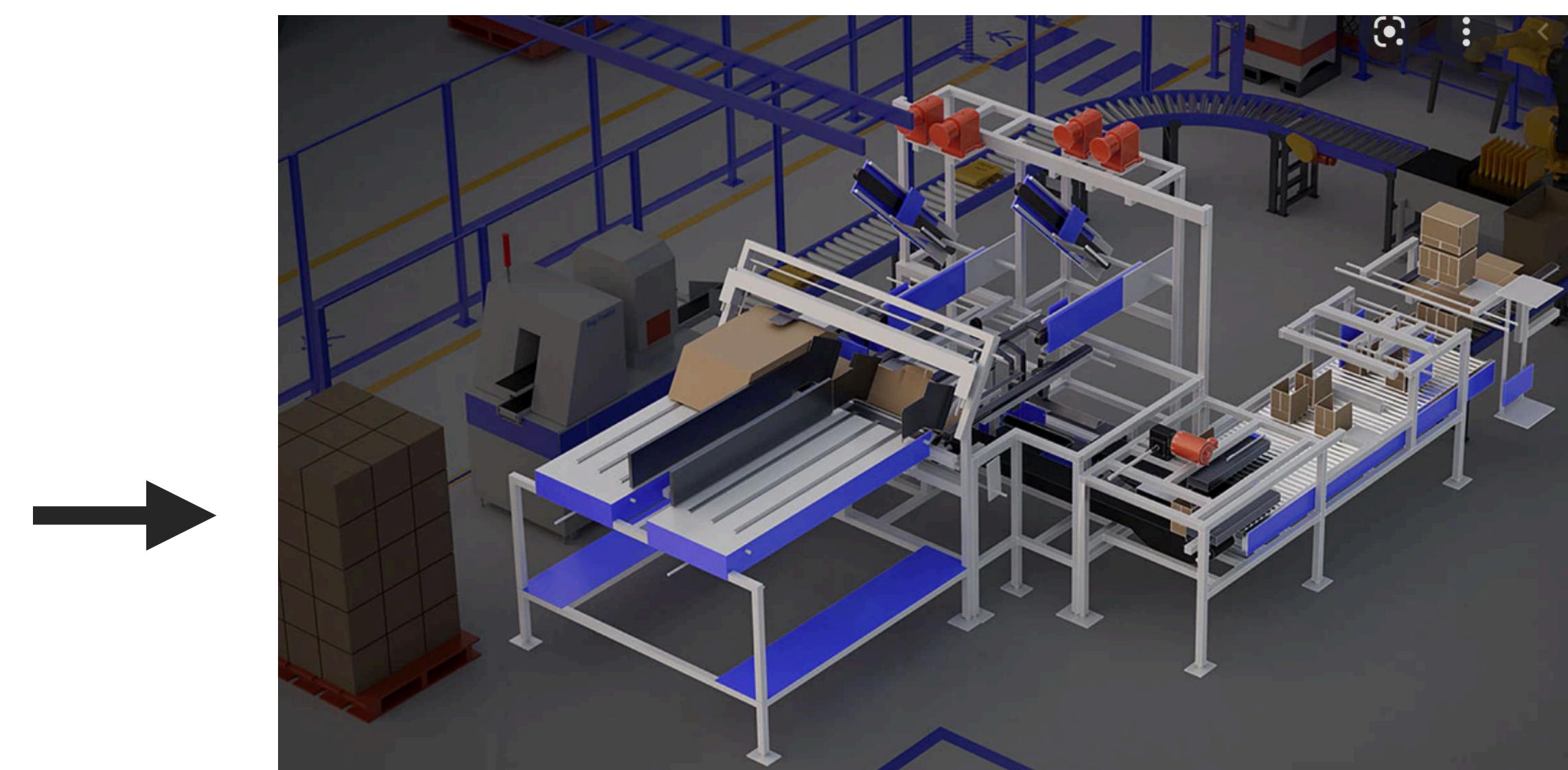
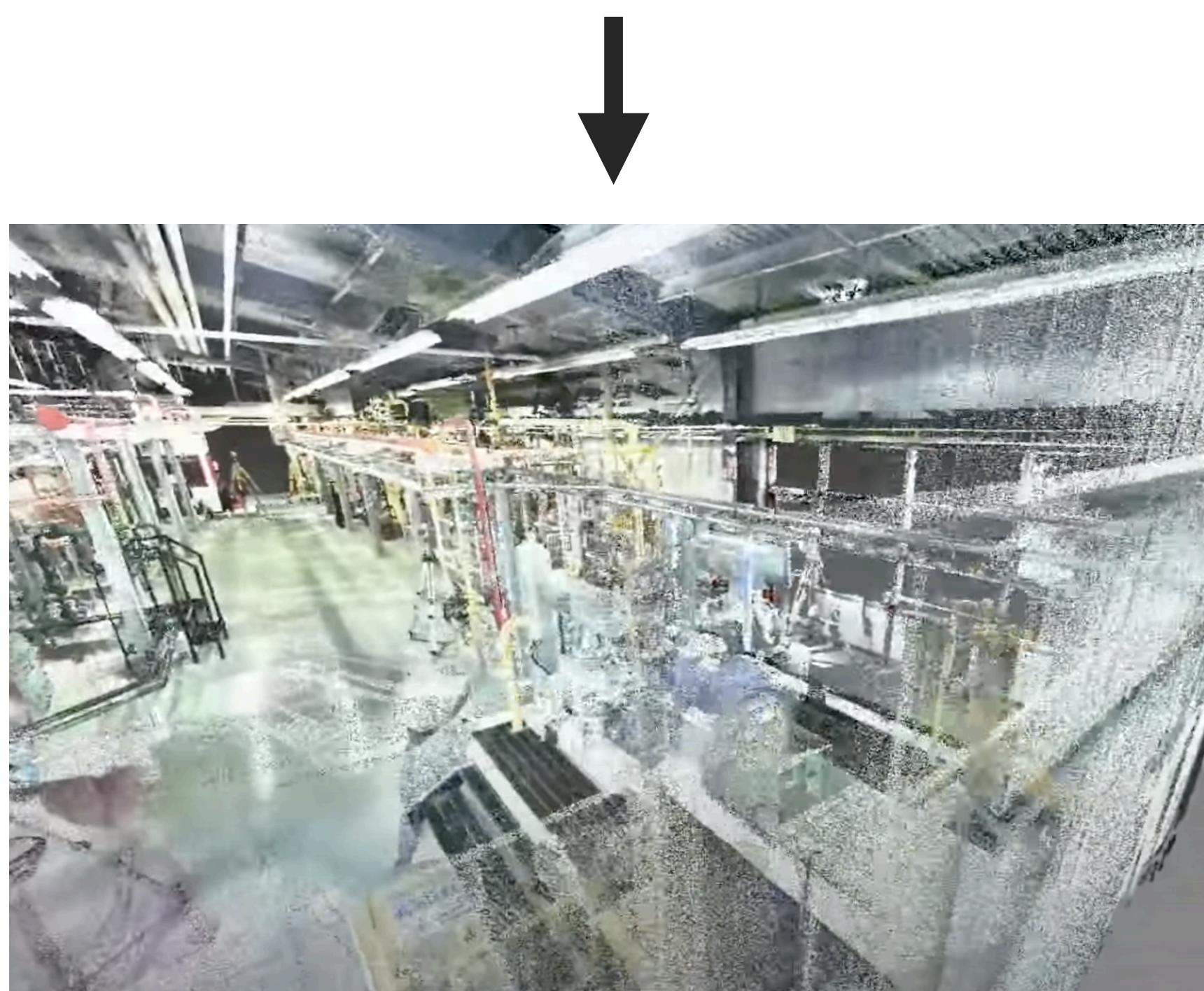
- Increased Efficiency
- Increased Flexibility
- Increased Throughput

- Reduced Floor Space
- Reduced Lead Times
- Reduced Labor Cost
- Reduced Material Cost

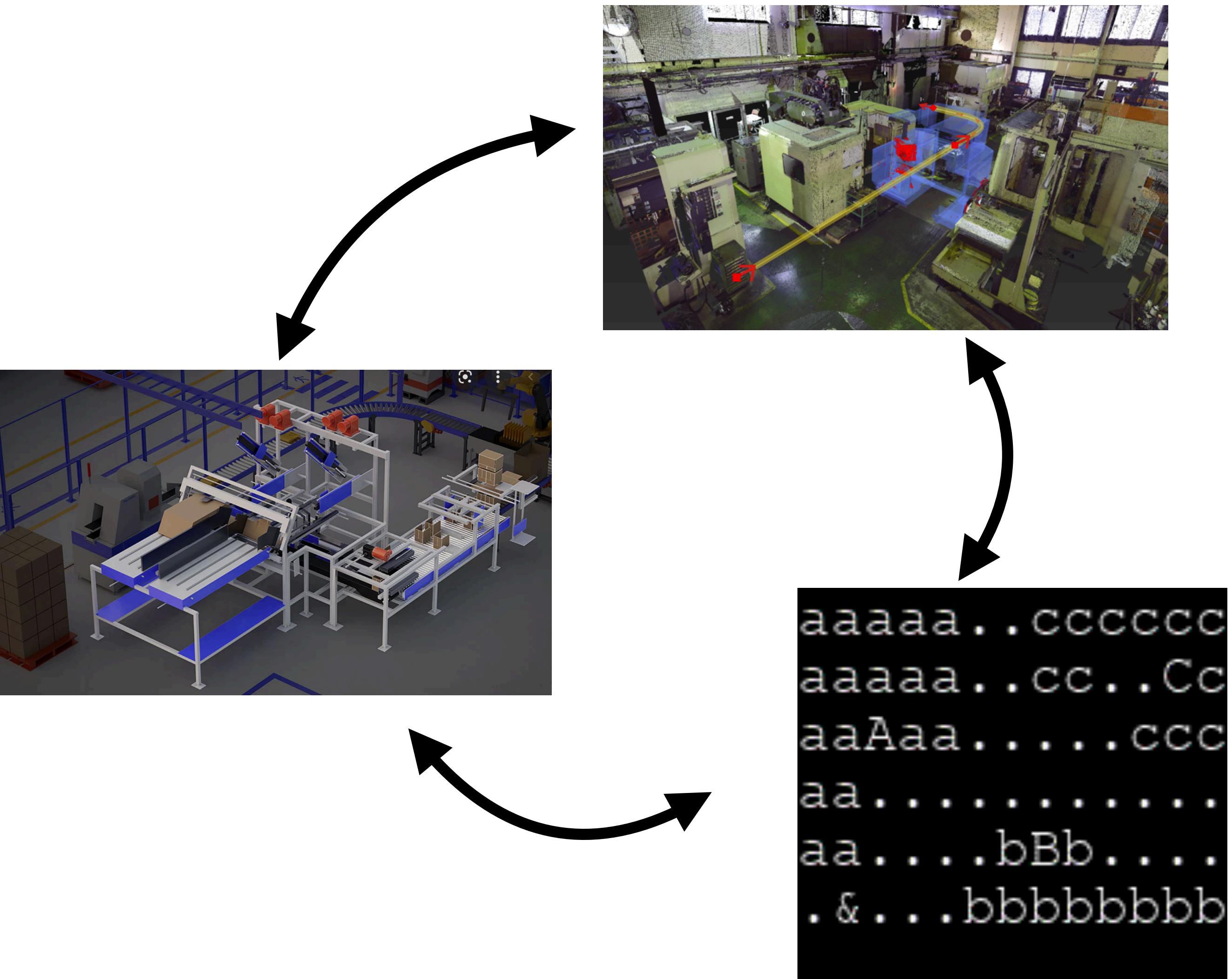
Demo - Optimize Factory Layout



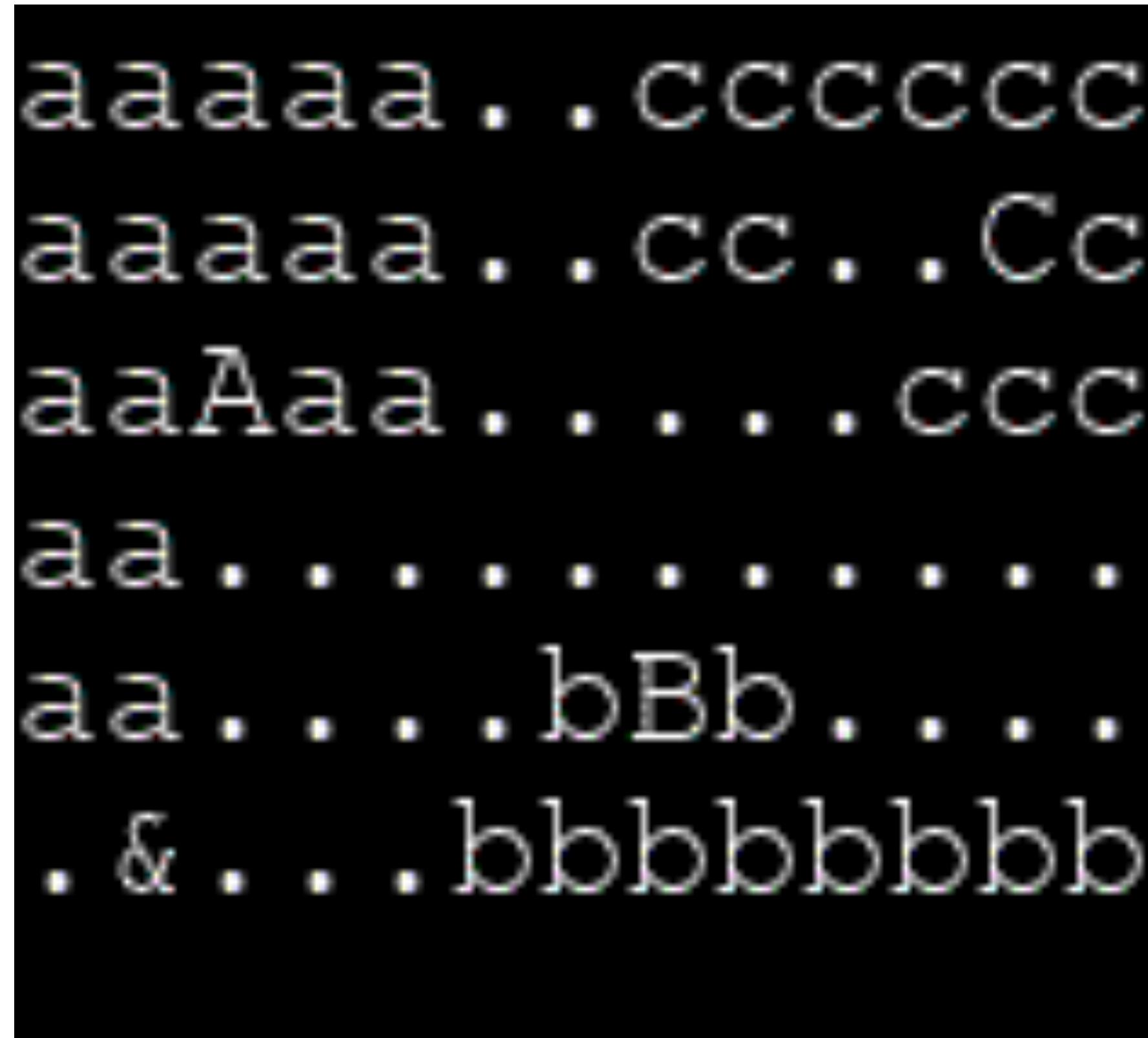
- Technician scans the factory into a point cloud
- Engineering converts the point cloud into a 3D model of the factory



- The 3D model is abstracted into a **simplified model**
- AI uses the simplified model to **simulate production** and evaluate different production plans
- The simplified model could be mapped back to 3D model to provide **realistic visualization** of the optimized production plan



Production Simulation



(click to animate)

- & is the worker
- @ is the starting position
- A, B, C are three different machines.
Lower case tiles are their body, upper
case tiles are their production output.
- The machines produce items in different
rates with some randomness.
- The worker grabs produced items from the
machines' outputs and moves them to the
starting location.

Layout Generation

.. bbbbbbbb ...	bbbbbbbb.....	.. ccccccaaaaa
.....bBb .. aabBbaaaaa.	.. cc .. Caaaaaa
.....aaaaaaaaaaaa.ccc .. Aaa
.. ccc ... aaAaa	... ccc ... Aaa.	.. bBb.....aaa
.. cC .. ccaaaaaa	... cC .. ccaa..	.bbbbbbbb.aaa
.@cccccccaaaaa	.@.ccccccaaa.	.@.....
bbbbbbbb.....	.bbbbbbbb....	
....bBb .aaaaabBb .. aa.	
.....aaaaaa	ccc.....aa.	
.. ccc.....Aaa	cC .. cc.aaAaa.	● ● ● ● ●
.. cC .. cc .. aaa	cccccc.aaaaaa.	
.@cccccc .. aaa	.@.....aaaaaa.	

- Alternative layouts are generated and correctness are validated based on physical constraints

Layout Evaluation

.bbbbbbbb....
....bBb....aa
ccc.....aa
cC..cc..aaAaa
cccccc..aaaaaa
. &.....aaaaaa

....cccccaaaaa
...cc..Caaaaaa
.....ccc..Aaa
.....aaa
...bBb....aaa
. &bbbbbbb....

.bbbbbbb....
....bBbaaaaaa
cccccc..aaaaaa
cc..Cc....Aaa
...ccc....aaa
. &.....aaa

bbbbbbbb....aa
....bBb....aa
.....aaAaa
..ccccccaaaaaa
..cc..Caaaaaa
. &...ccc.....

....bbbbbaaaaaa
....bBb..aaaaaa
ccc.....aaAaa
cC..cc..aa...
cccccc..aa...
. &.....



(click to animate)

- AI reads the layouts, simulates the production, and evaluates the simulation
- AI learns how to better generate layouts overtime

aaaaaa...cccccc
aaaaaa...cc..Cc
aaAaa....ccc
aa.....
aa....bBb....
. &...bbbbbbbb

Initial Design

.bbbbbbbb....
....bBaaaaaa
cccccc..aaaaa
cc..Cc....Aaa
...ccc....aaa
. &.....aaa

Final Design

2.94

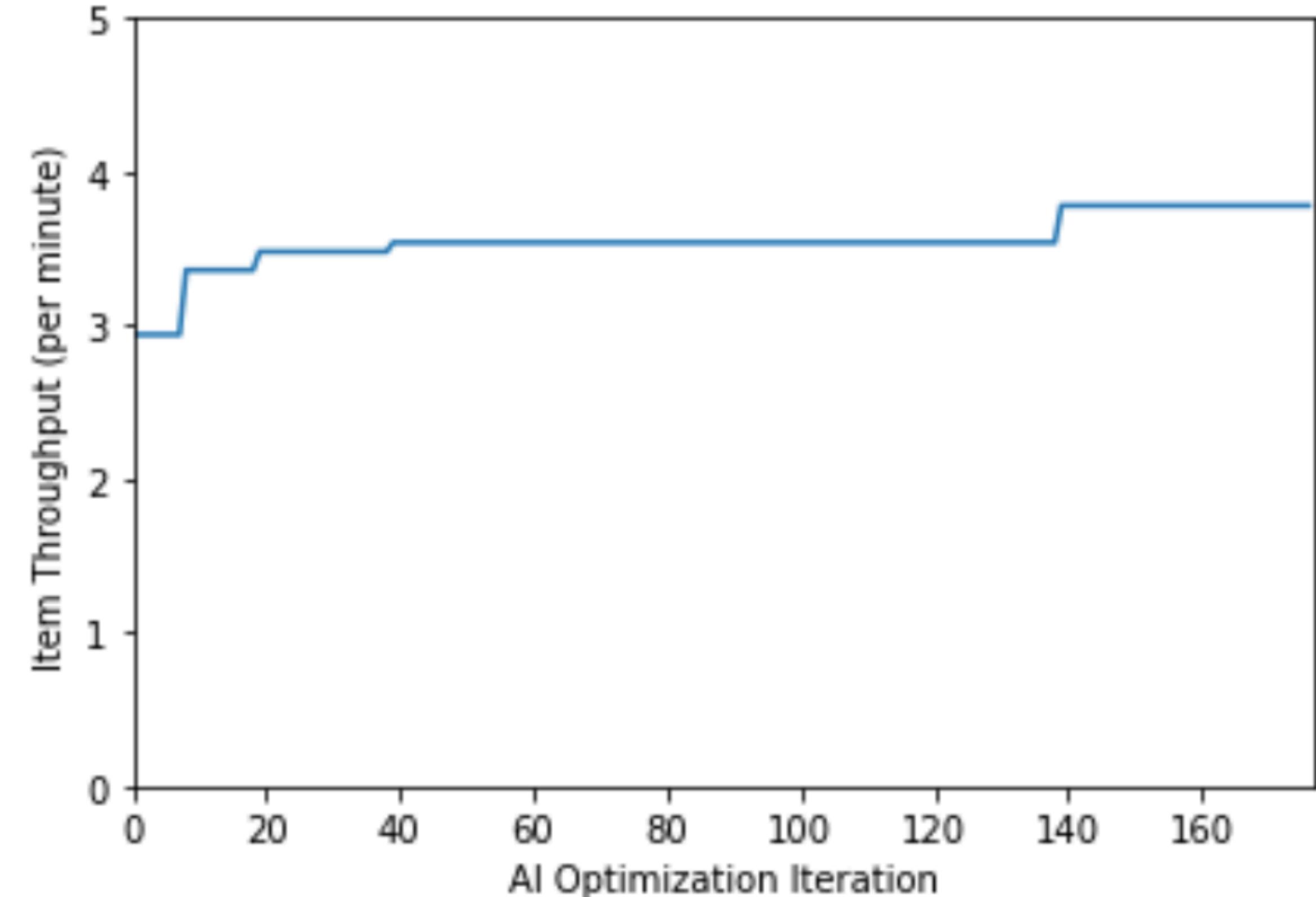
Initial Design Productivity

3.78

Final Design Productivity

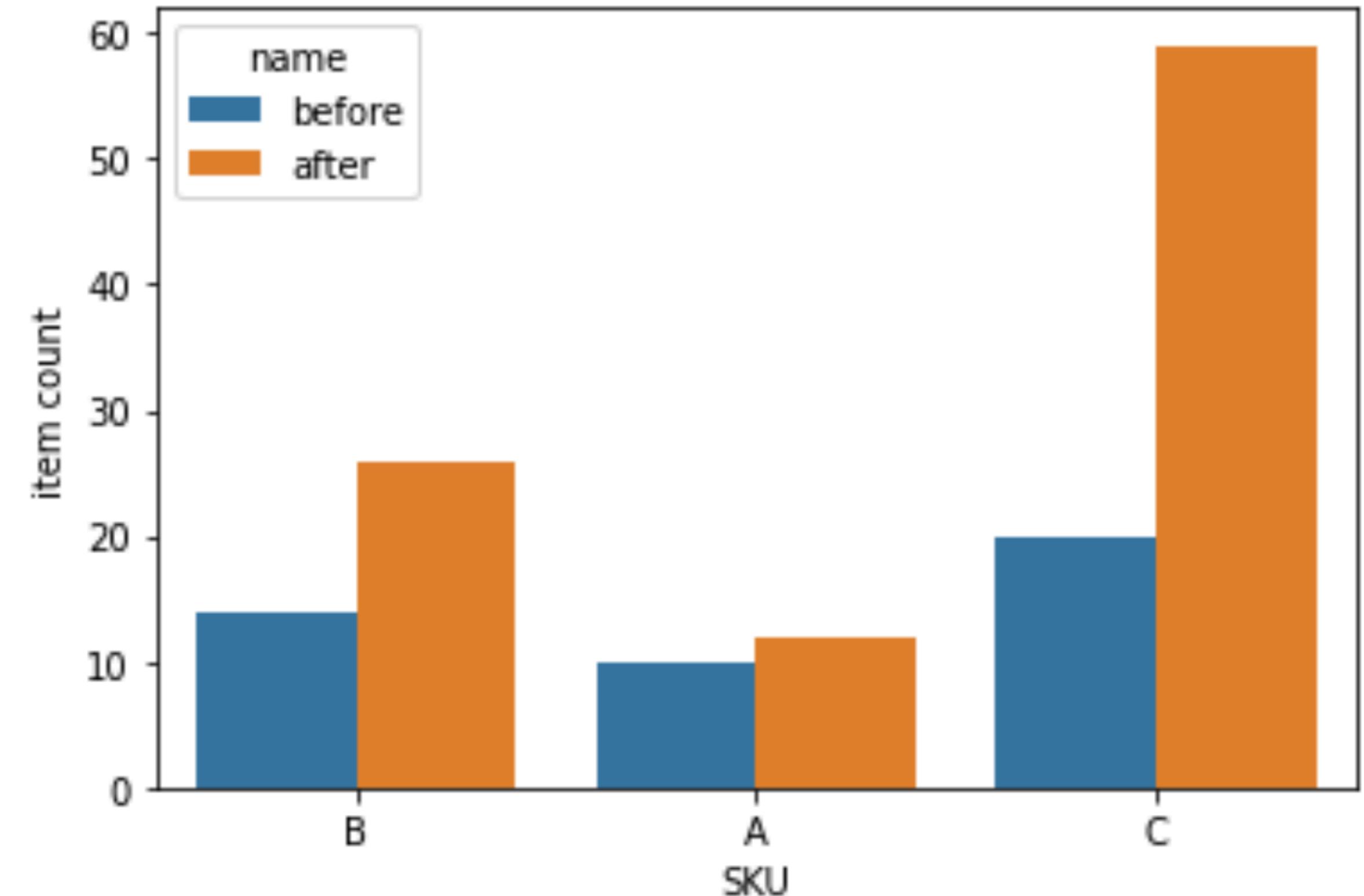
29%

Productivity Improvement



**Improved
Throughput and
Lead-Time for**

ALL SKUs



THANK YOU

(Source code of the demo can be found in the compressed file)

