Smart Robots

Industrial Applications

Question?

Could smart robots replace humans in industrial Facilities?

What makes a robot smart?

It is able to follow a series of pre-programmed instructions specified by the user or engineer

It is able to makes an observation about the outside world

It has a central computer or other type of controller that interprets both the instructions in the software and the data from the sensor

It is able to make a decision and react based on the observation, following the instructions defined in the program

It is able to complete all of the preceding steps automatically, without human intervention

Roomba

Factory Robots

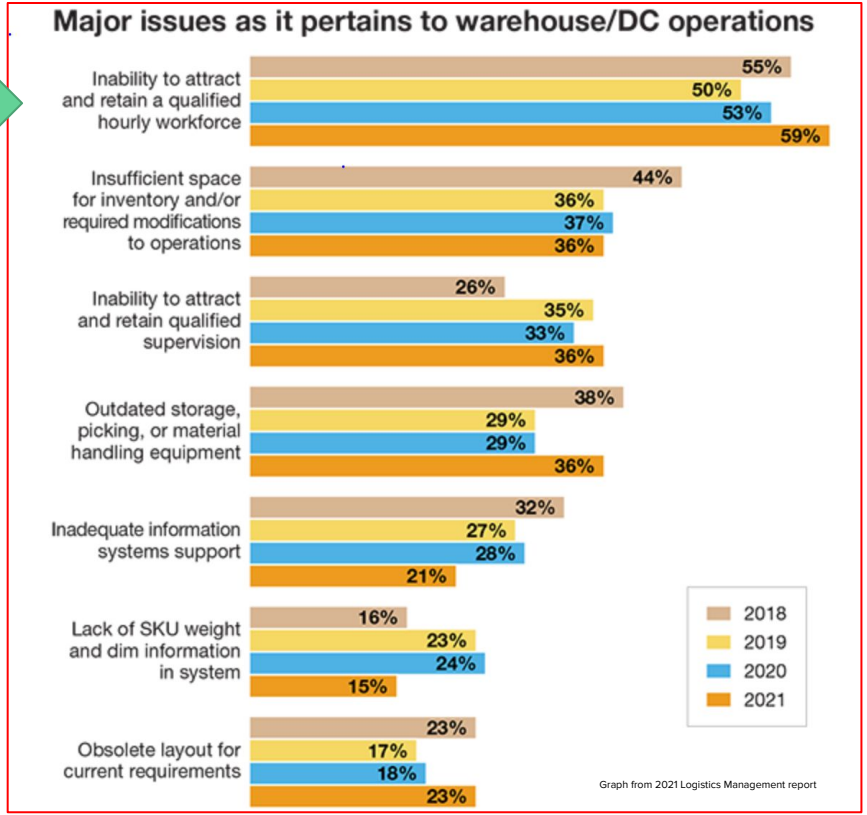
Warehouse robots

https://www.youtube.com/watch?v=FBl4Y55V2Z4

Why produce smart robots?

Labor Demand

- “inability to attract and retain a qualified hourly workforce was the leading industry issue, cited by 55% of respondents”-Logistics Management 2018

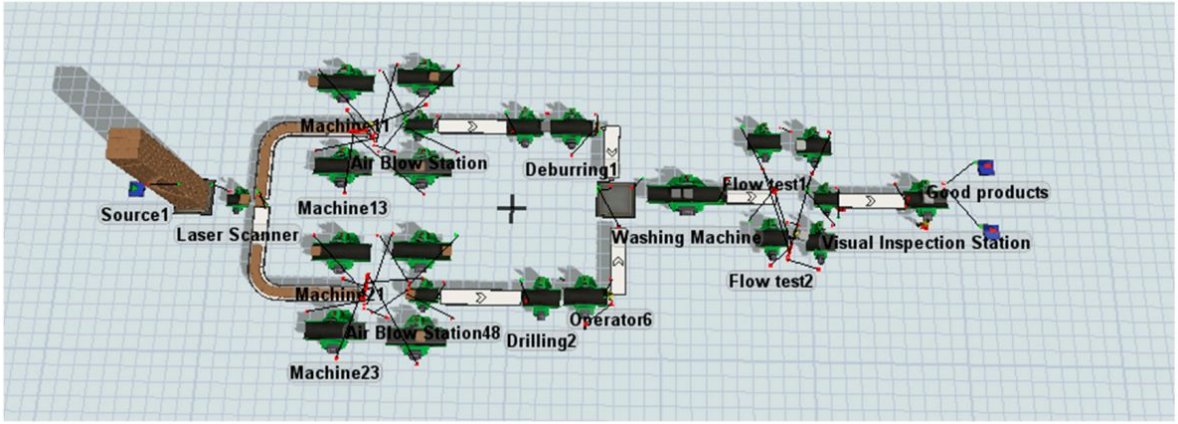


Efficiency

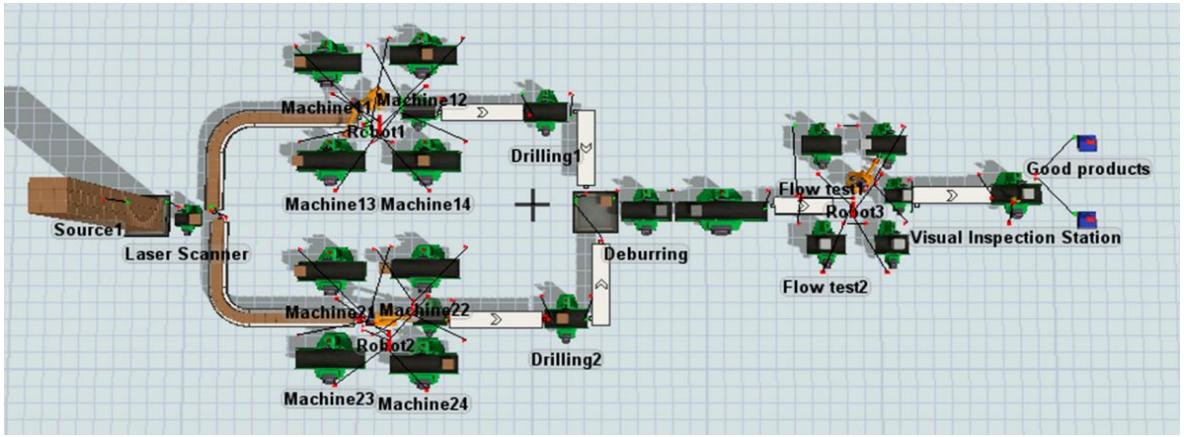
Smart Robot Advantages

- Allow for stable fast work
- Low Failure Rate
- Low labor cost

Model of a human operated line

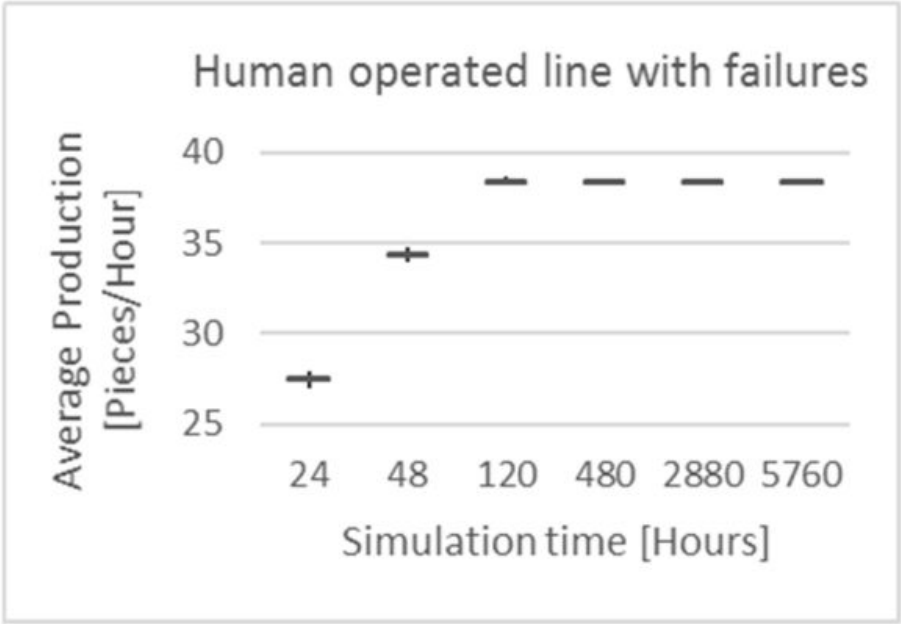


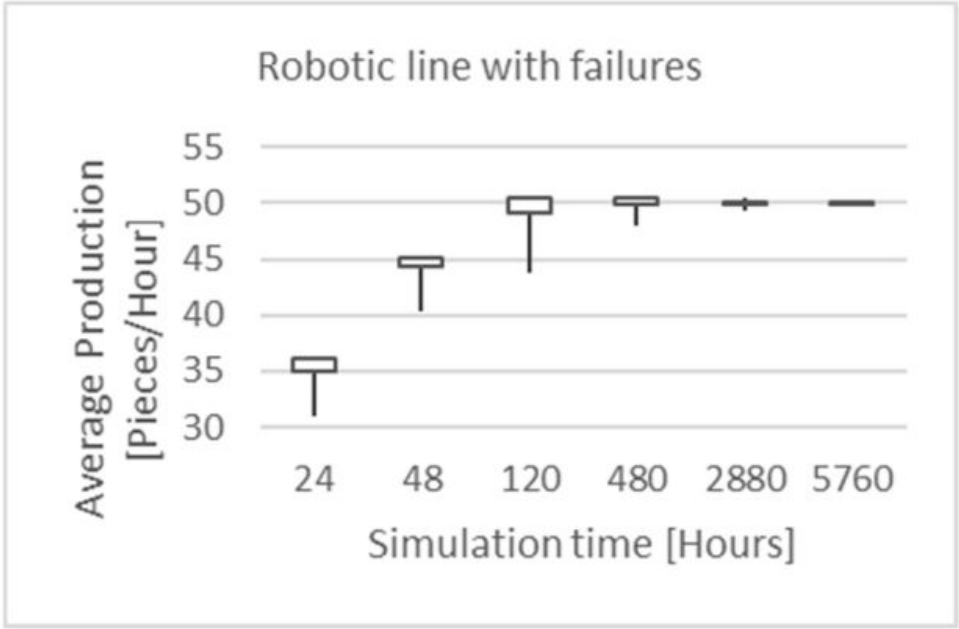
Model of a Machine operated line



Simulation Time [h]	Production Limit *PL* [Pcs.]	Human Operated Line			Robotic Line		
		Average Production *Pavg* [Pcs.]	Std. dev.	*OFE*	Average Production *Pavg* [Pcs.]	Std. dev.	*OFE*
24	1536	660.3	4.9	0.429883	855	34	0.556641
48	3072	1647.8	10.4	0.536393	2145	56	0.698242
120	7680	4605.3	14.6	0.599648	5974	211	0.777865
480	30,720	18,453	36	0.600684	24,045	311	0.782715
2880	184,320	110,537	84	0.599702	144,116	748	0.781879
5760	368,640	221,156	134	0.599924	287,852	1001	0.780849

Image source





“The efficiency of manual machine tending was about 40%–60% and, for robotic machine, tending was about 90%”-Efficiency Analysis of Manufacturing Line with Industrial Robots and Human Operators

Cost

Human Cost

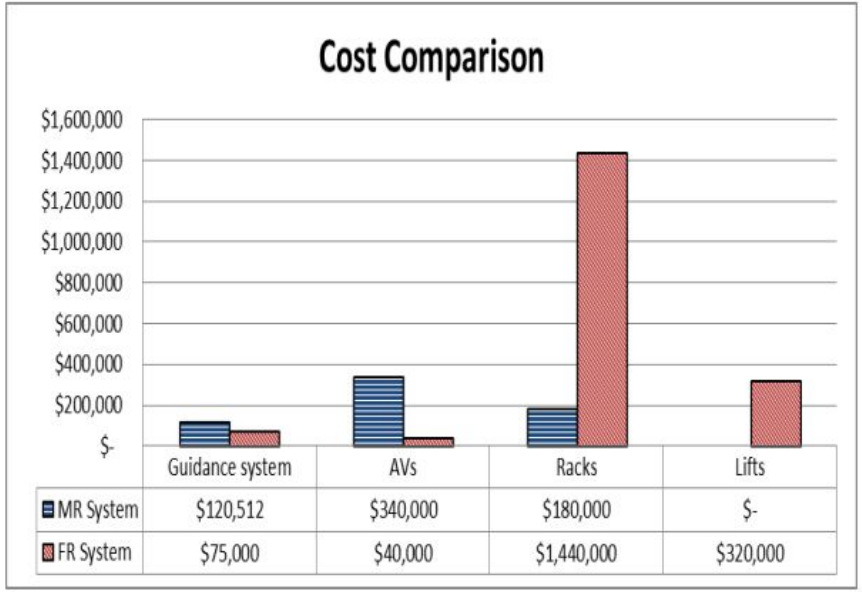
- “Total costs for warehouse labor could be around $50,000”-Kane Logistics

- Avg employees per warehouse: 150 (Logistics Management)
  - 150x50,000=7.5million annually

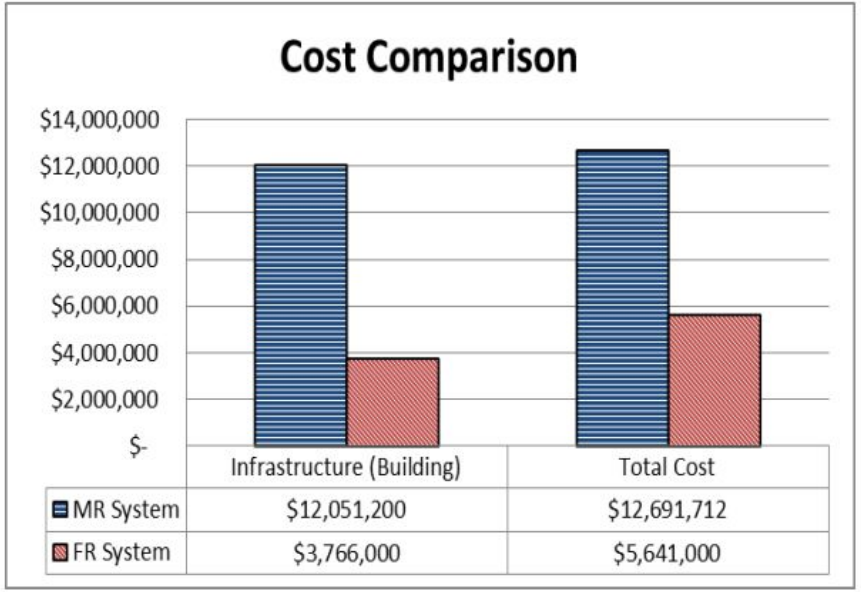
Robot Cost

Cost Assumptions		
Costs	*MR System*	*FR System*
Infrastructure(Building)	$ 200/ft^2	$ 200/ft^2
Guidance System	$ 2/ft^2	$ 50/ft
AVs	$ 20,000/AV	$ 10,000/AV
Racks	$ 180/Rack	$ 3,600/Rack
Lifts	NA	$ 40,000/Lift

Smart Warehouse costs



	Guidance system	AVs	Racks	Lifts
MR System	$120,512	$340,000	$180,000	$-
FR System	$75,000	$40,000	$1,440,000	$320,000



	Infrastructure (Building)	Total Cost
MR System	$12,051,200	$12,691,712
FR System	$3,766,000	$5,641,000

Conclusion

Human vs Robot

	Human Factor	Robot Factor
Work parameters	Unstable, slow work, fatigue	Stable, fast work
Adaptation for new task	Fast adaptation	Slow programming
Flexibility, working area	Large flexibility, large operating range	Lower flexibility, limited range
Errors and failures	High human errors rate	Low failures rate
Replacement and repair	Can be replaced	Require repairing
Labour cost	High	Low
Investment cost for human/robot workstation	Low	High

My Answer

Q:

Could robots completely replace human workers in industrial Facilities?

A:

Based on what i found,it is not likely within the next 10 years but the possibility is plausible.

References

Neira-Rodado D, Ortíz-Barrios M, De la Hoz-Escorcia S, Paggetti C, Noffrini L, Fratea N. Smart Product Design Process through the Implementation of a Fuzzy Kano-AHP-DEMATEL-QFD Approach. *Applied Sciences*. 2020; 10(5):1792. https://doi.org/10.3390/app10051792

Questions?