



Horticulture 4.0 Conference



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Error Proofing in Niche Volume Engine Assembly

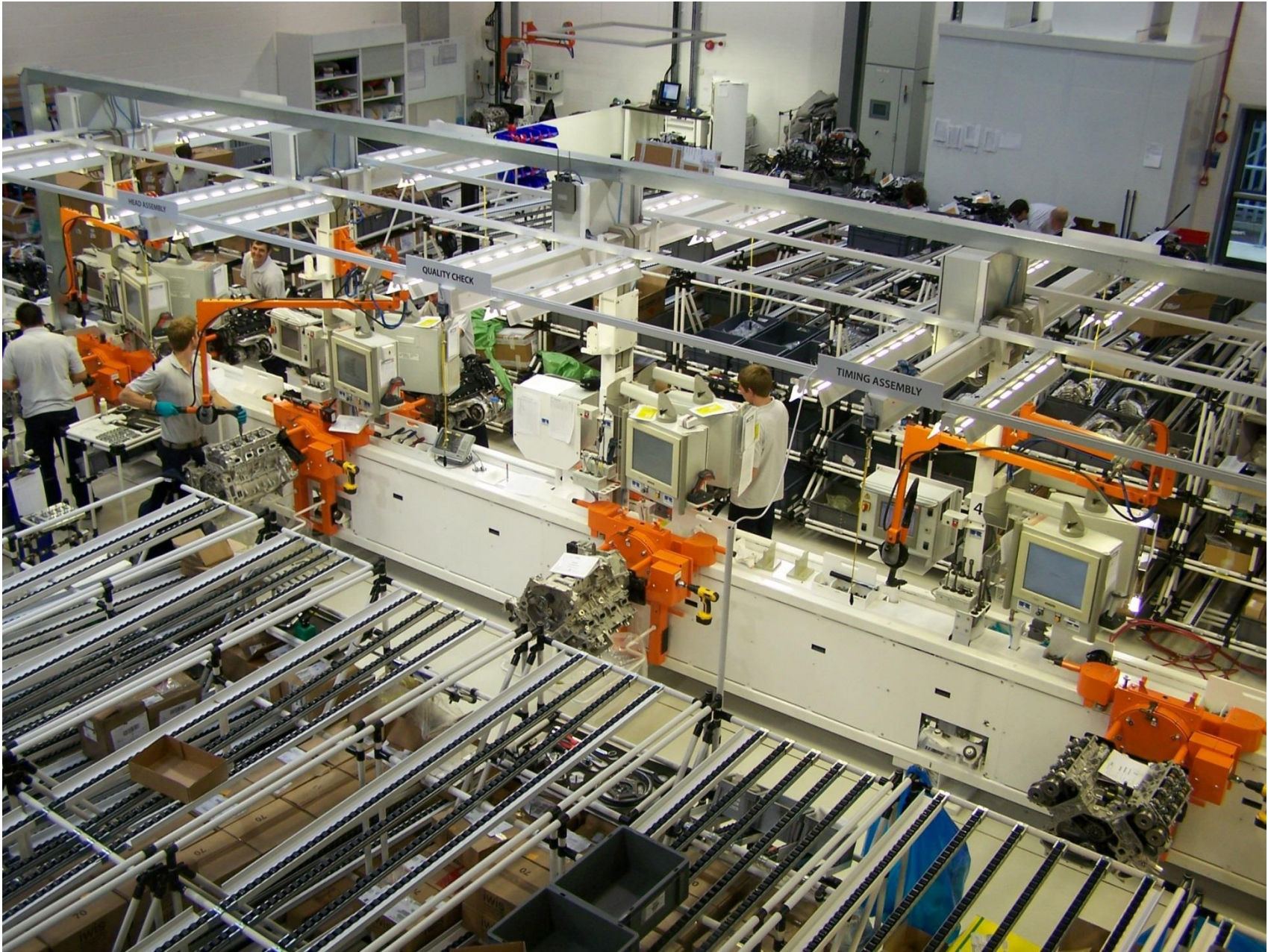
Lean manufacturing to Factory 4.0

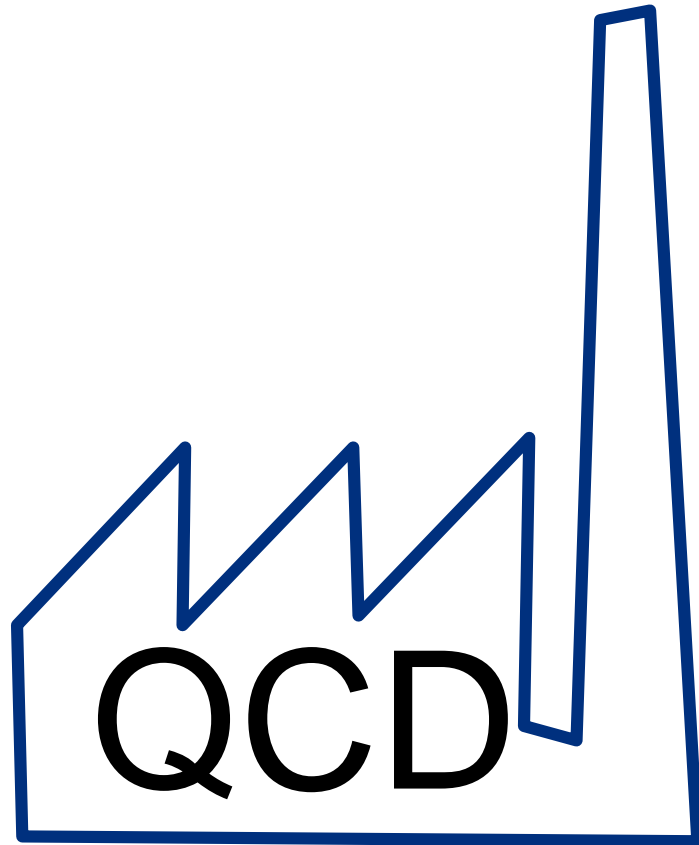
26 October 2018

Dave Thompson

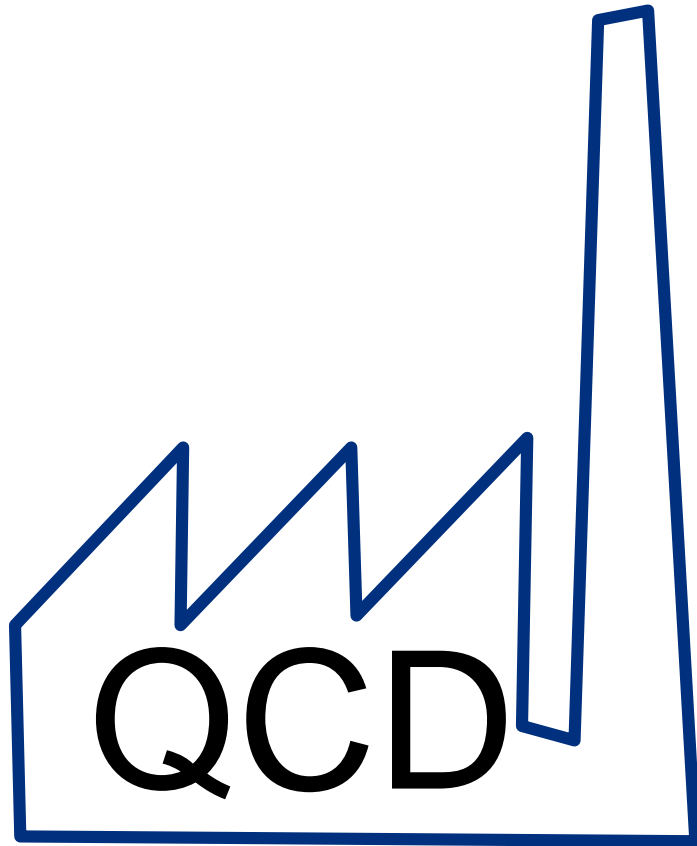
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Ricardo Niche volume Engine manufacture





Quality
Cost
Delivery

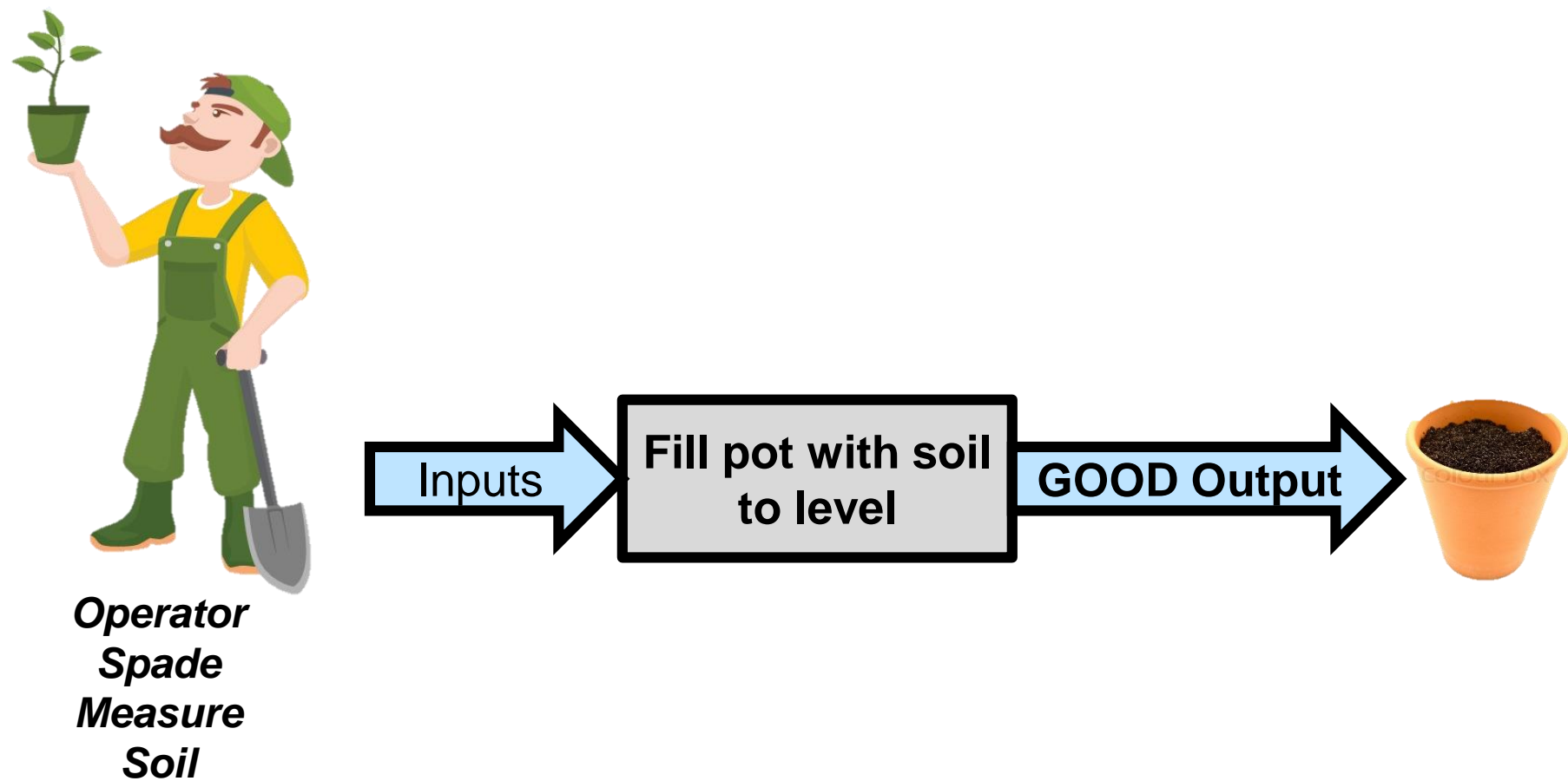


Lean is about eliminating waste.

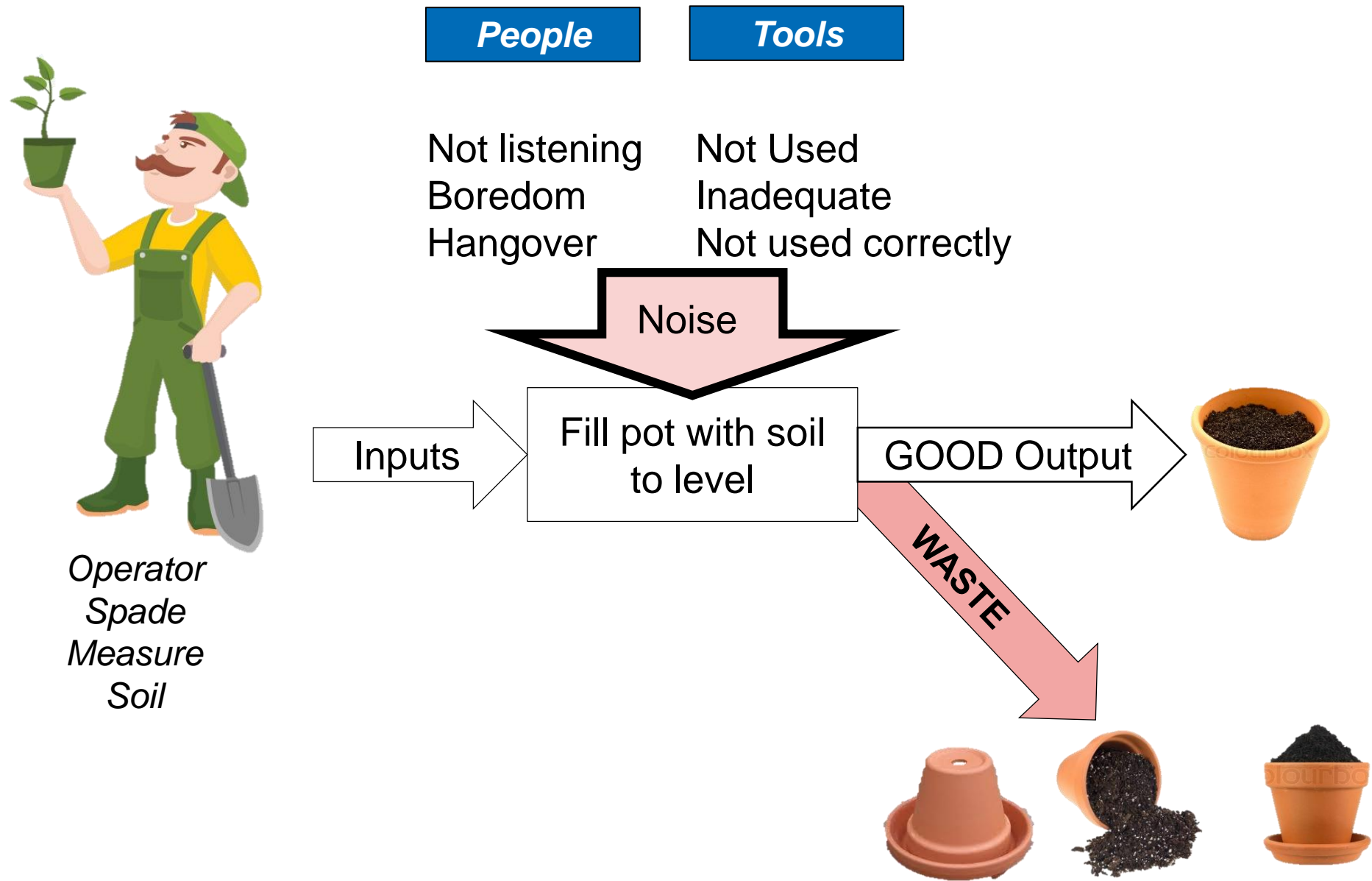
Waste is an activity that does not add value.

Value is an activity that transforms the product in the way the customer is willing to pay for.

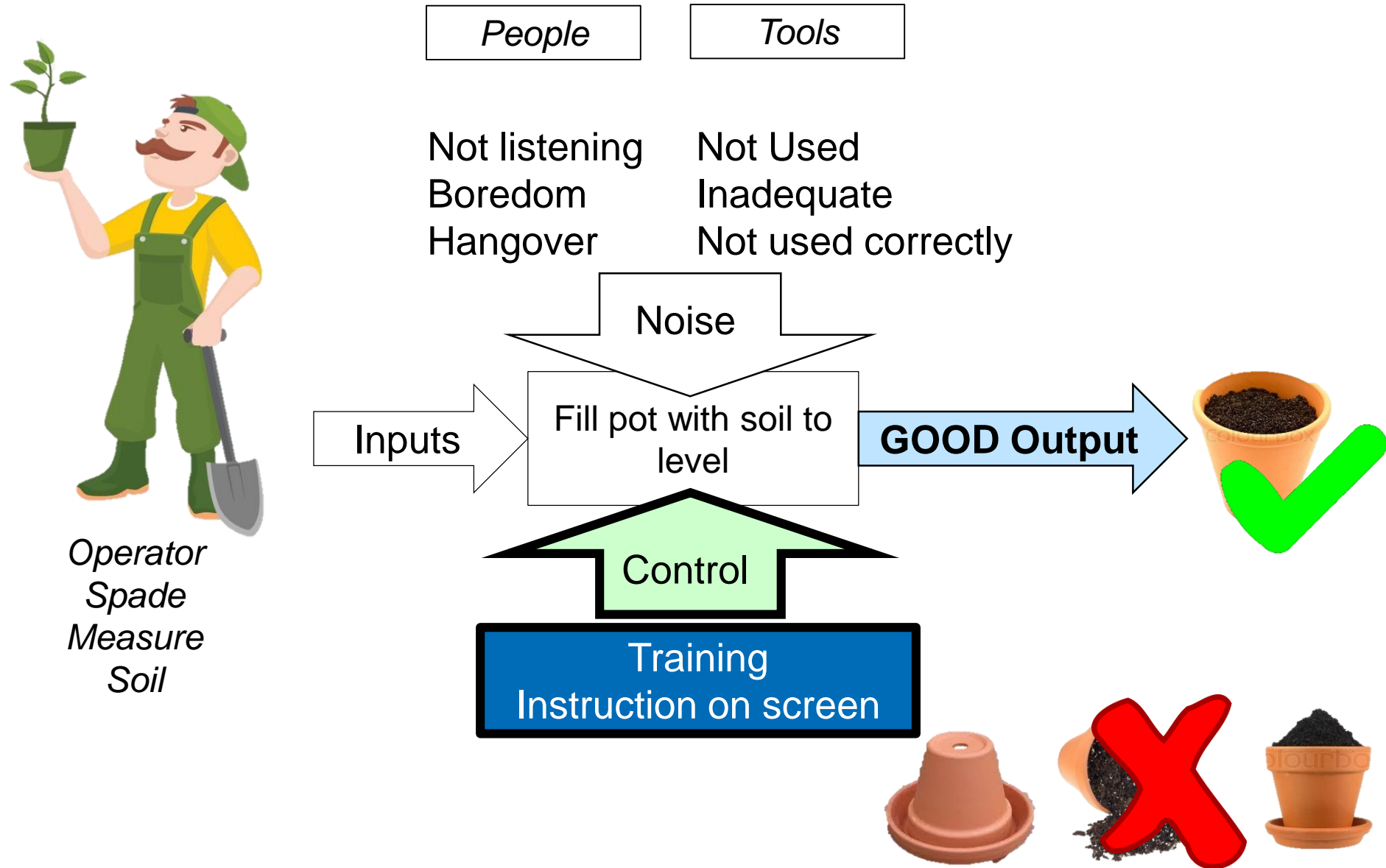
P diagram for an 'operation' or 'build step'



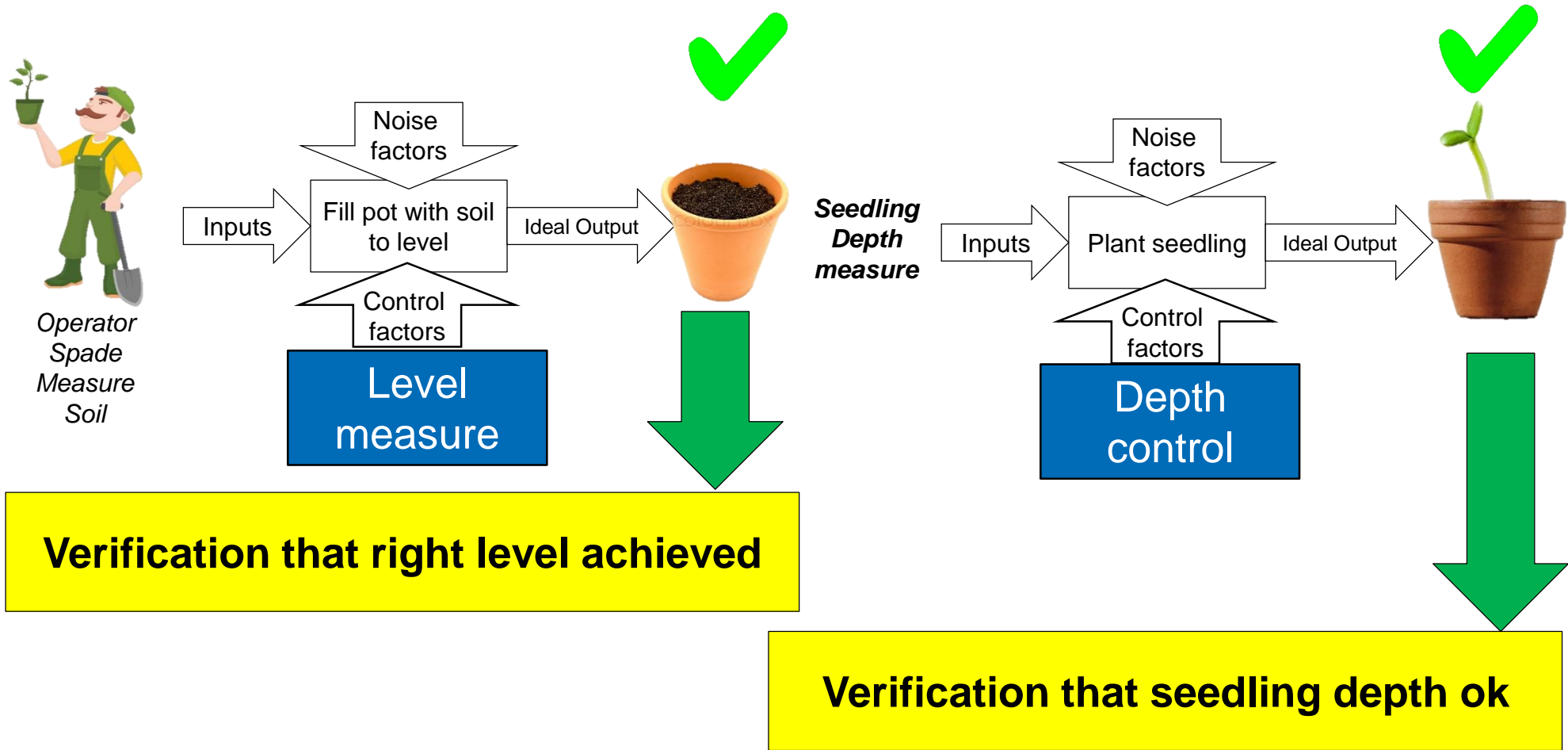
P diagram 'noise'



P diagram 'control'



P diagram ‘No faults forward’



“No faults forward”



Complex operation... but
'easy' to errorproof



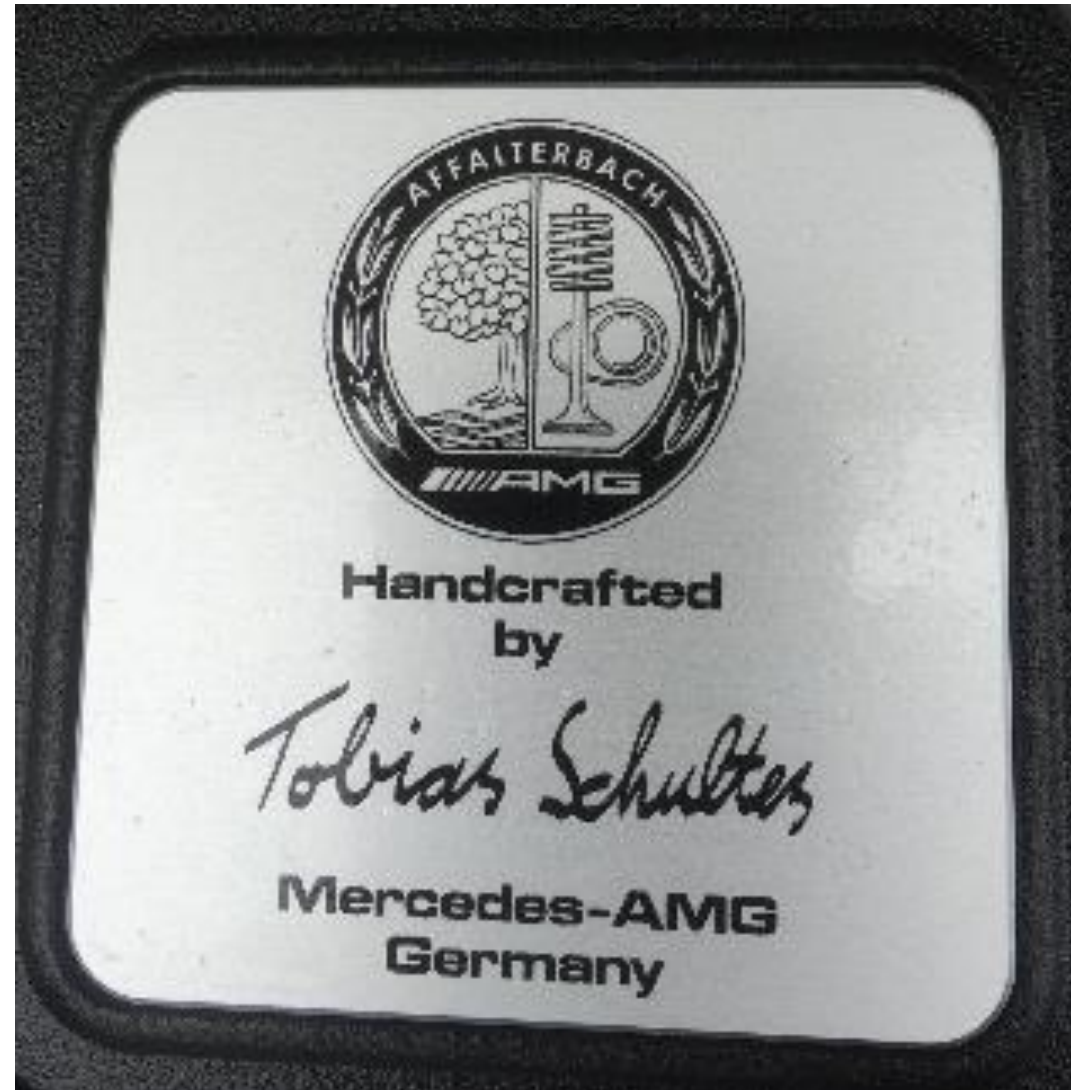
Easy operation... but
complex to errorproof

Error proofing summary matrix



Activity	Tool	Sensors	Feedback	No (definite) feedback	How checked?
Rundown Fasteners	Nutrunner	Torque angle	Tightening profile OK/NOK Number of rundowns	Correct sequence Correct Fastener Correct component	Cannot check after assembly Audit check if visual access allows
Engine component complexity	Manual selection	Pick to light QR code reader	Correct part picked	Correct part assembled	Audit check if visual access allows
Liquid sealant	CNC applicator of sealant to part	Proximity Time Vision	Correct part to apply sealant too Assembled within time band Continuous bead of sealant	Part was checked before sealant applied Seal bead wasn't smeared by assembly	Cannot check after assembly
Use of tools to aid assembly	Guides, masks, alignment pins etc	Proximity sensors	Tool was used	Tool was used, or used in every application	Cannot check after assembly
Press fit parts – hoses, electric harness fir tree, electrical connectors	Manual push fit	Electrical check	Harness continuity check (for electrical connectors)	Hoses fully fitted, fir trees pressed home, electrical connectors fully latched	Audit check if visual access allows

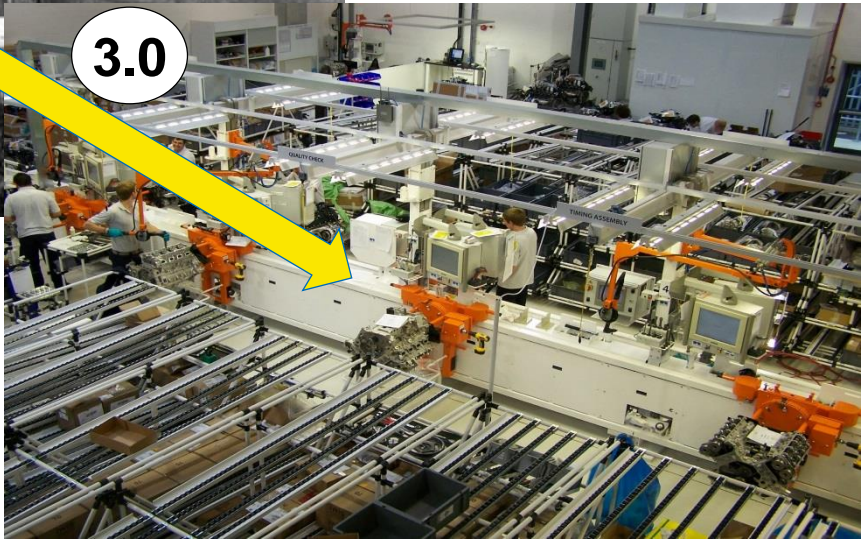
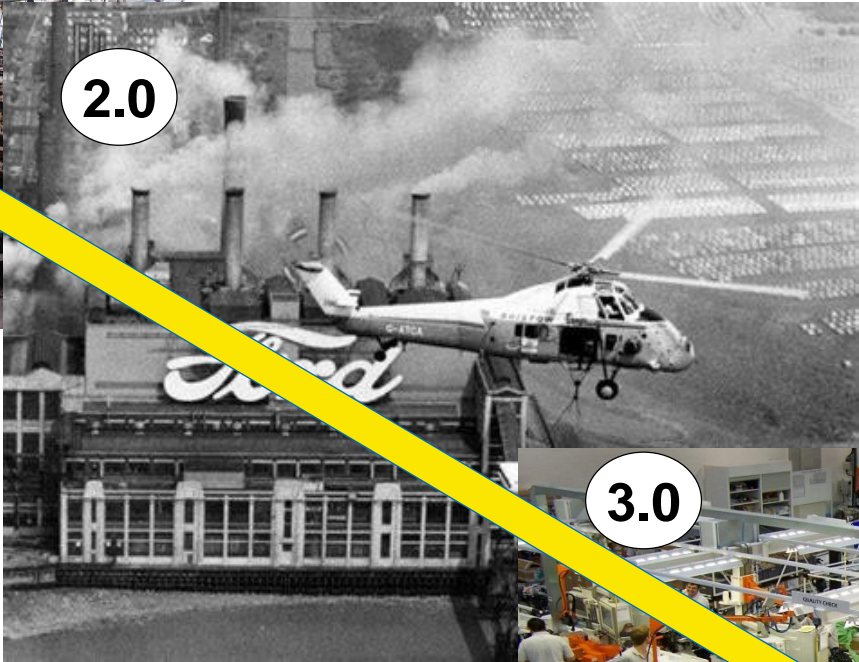
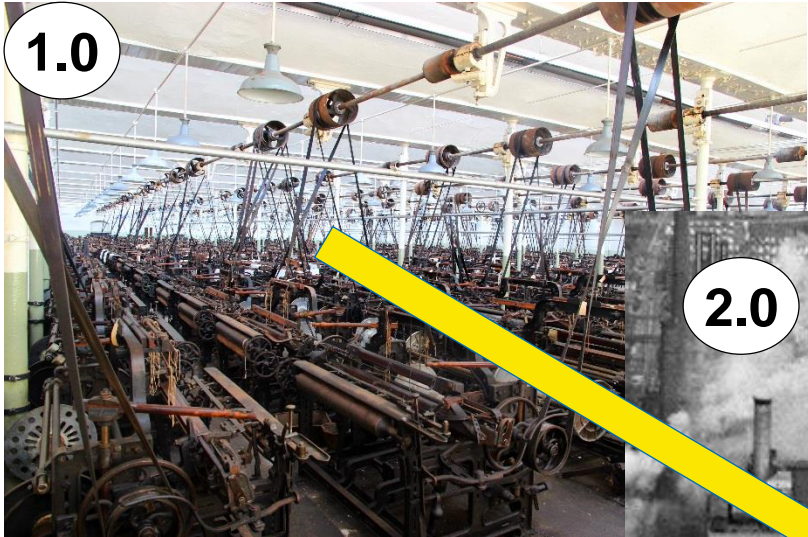
“Shisa kanko”



Difficult to errorproof.....



Industrial Revolution 1.0, 2.0 and 3.0



SMART FACTORY

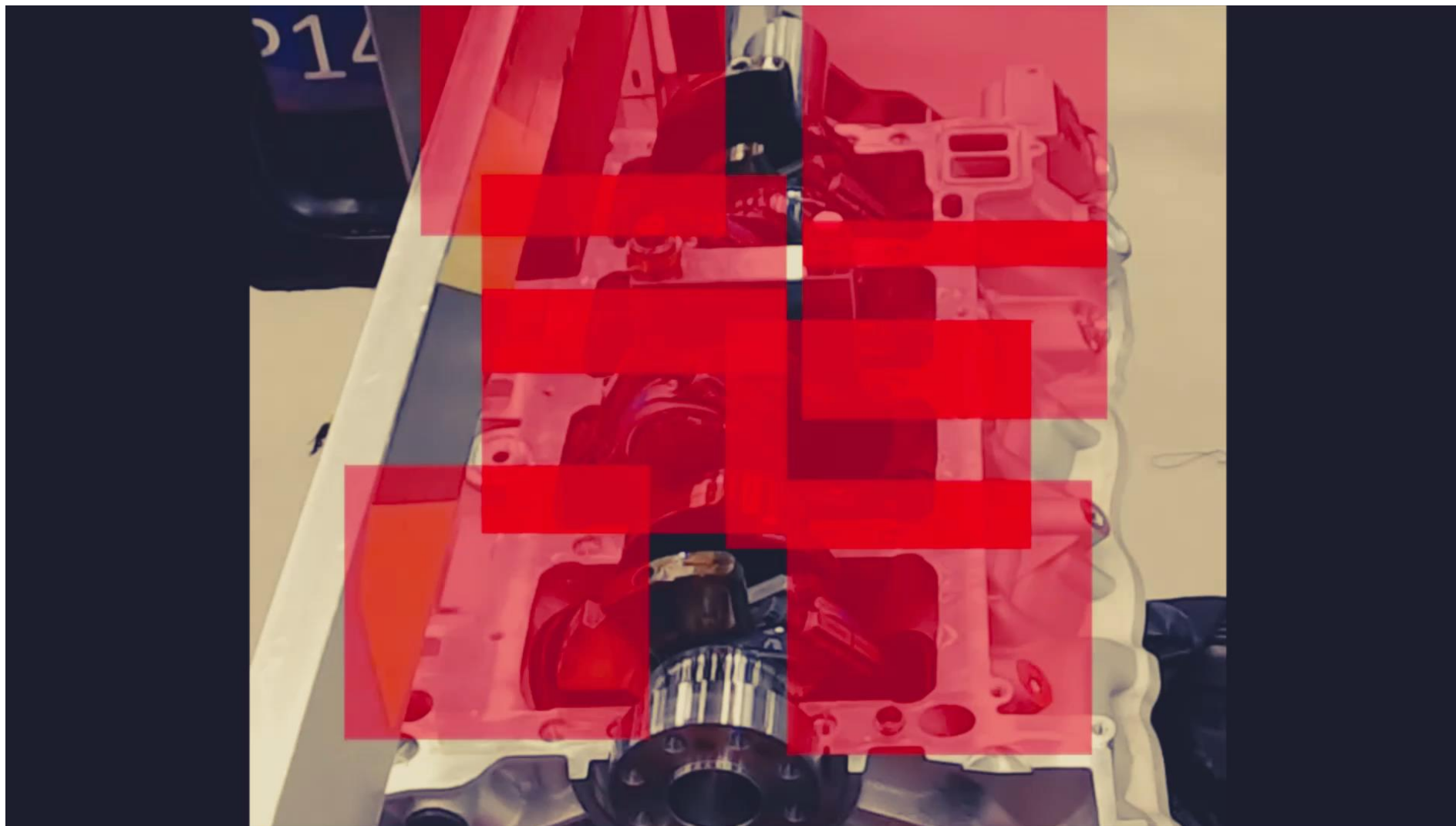


.....cognitive computing and artificial intelligence....

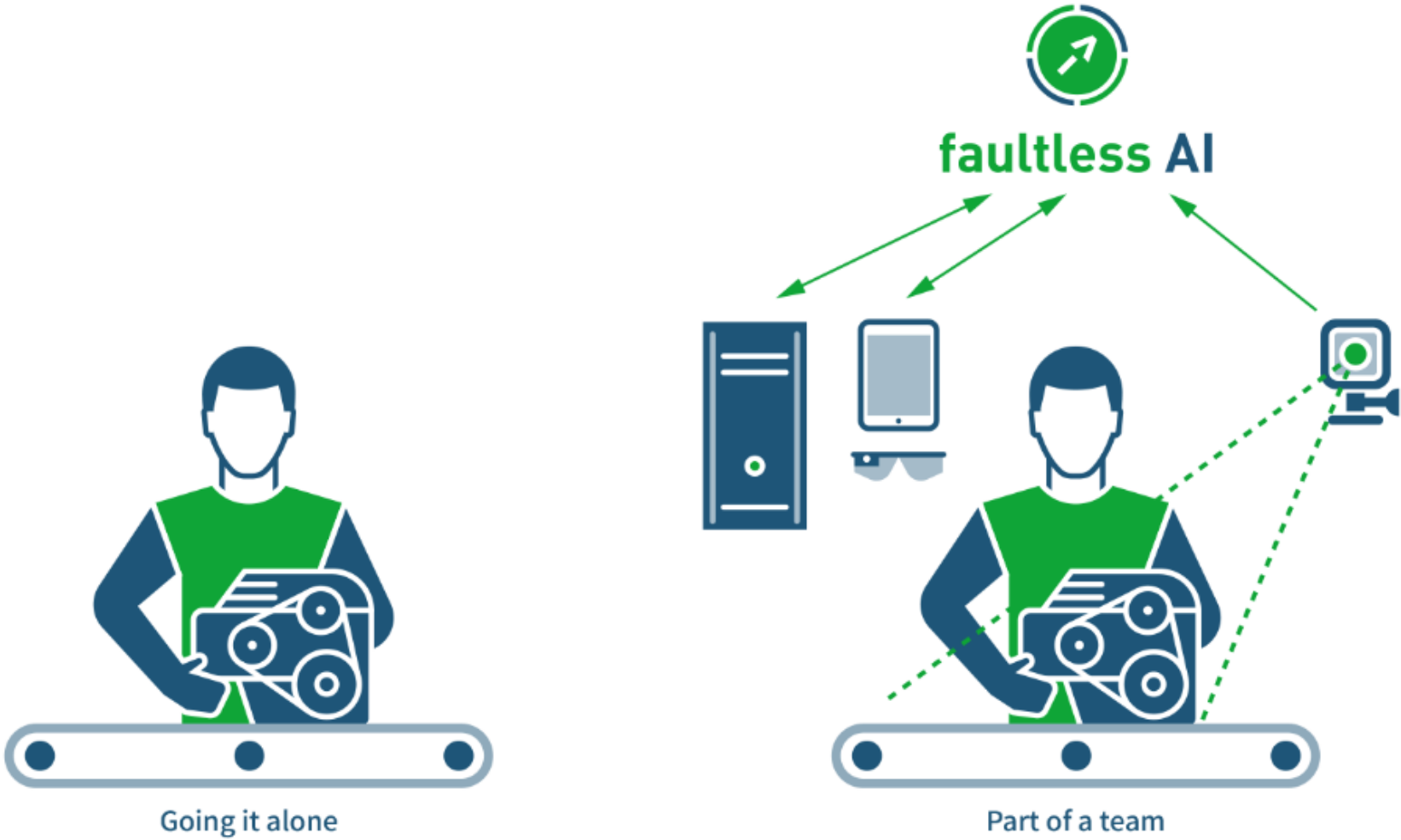


faultless AI

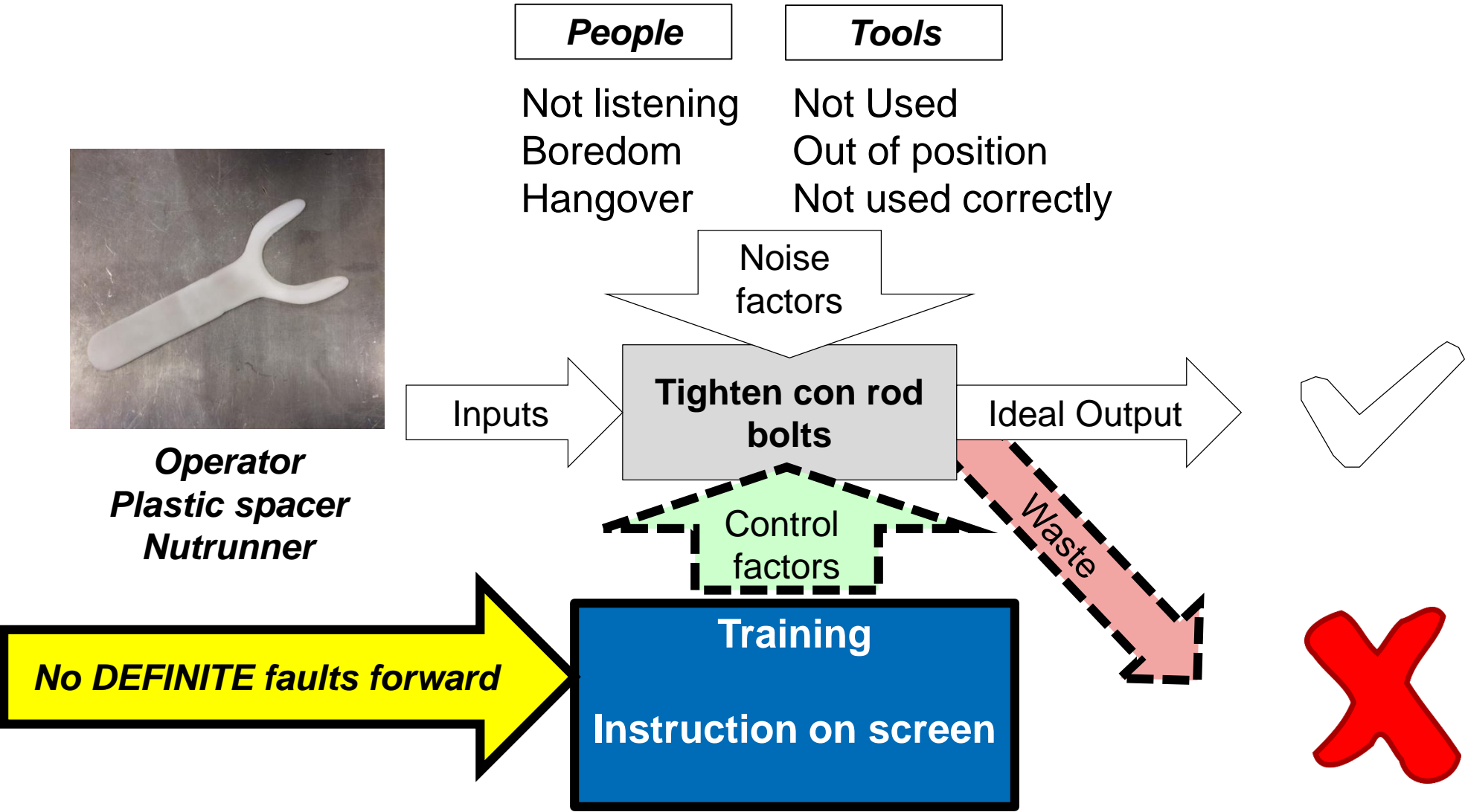
replacing robots with people



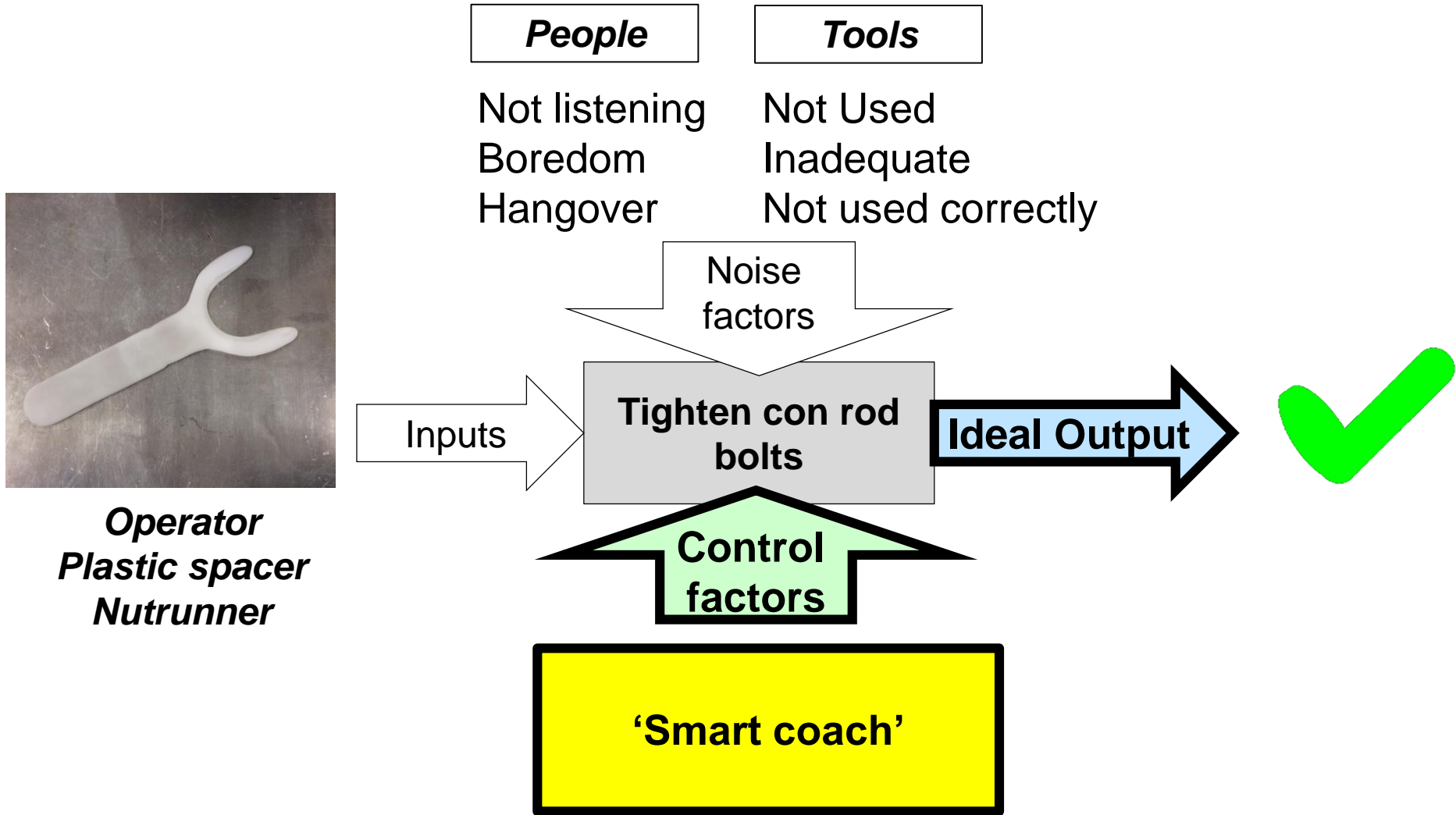
A different approach



P diagram 'current state'



P diagram 'future state'





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Thank you

