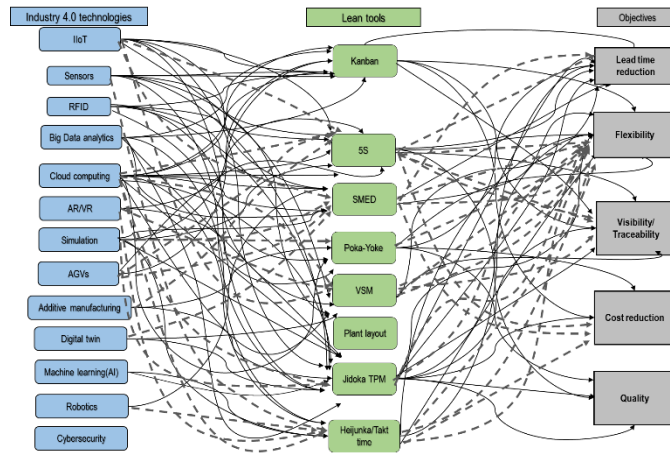


# Integration of industry 4.0 technologies and lean management techniques to optimize enterprise performance

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The current industrial context requires flexible processes that can adapt to fluctuant market demands. Both, Lean and Industry 4.0 can achieve the company's objectives separately, however, several studies have shown that the combination of these two concepts is appealing to companies.

The target of this thesis is to thoroughly study the combination between Lean management tools and Industry 4.0 technologies. Different paths are possible to achieve optimization in factories/enterprises and Supply chains. The aim is to browse the existing studies subscribing path 1 (where I4 technologies are essential followed by LM techniques) and those subscribing to path 2 claiming that LM tools are a prerequisite to initiate Industry 4.0 transformation. The thesis will first provide a cartography with the possible combinations and the impacts on performance objectives of path 1 and path 2 configurations. The final objective is to provide a decision aided tool based on the algorithm of paths identification to assist managers in their decision-making process.



Industry 4.0 Technology	Lean Tool	Objective
IoT	Kanban	Lead time reduction
Sensors	SS	Flexibility
RFID	SMED	Visibility/Traceability
Big Data analytics	Poka-Yoko	Cost reduction
Cloud computing	VSM	Quality
AR/VR	Plant layout	
Simulation	Jidoka TPM	
AGVs	Heijunka/Takt time	
Additive manufacturing		
Digital twin		
Machine learning/AI		
Robotics		
Cybersecurity		

I4.0 Technology	Lean Tool	Objective
+171 L1+	SS	Lead time reduction
+172 L1+	SS	Flexibility
+173 L1+	SS	Quality

I4.0 Technology	Lean Tool	Objective
+174 L1+	SS	Lead time reduction
+175 L1+	SS	Flexibility
+176 L1+	SS	Quality

I4.0 Technology	Lean Tool	Objective
+177 L1+	SS	Lead time reduction
+178 L1+	SS	Flexibility
+179 L1+	SS	Quality

I4.0 Technology	Lean Tool	Objective
+180 L1+	SS	Lead time reduction
+181 L1+	SS	Flexibility
+182 L1+	SS	Quality

Lean Tool	Objective
Kanban	Lead time reduction
SS	Flexibility
SMED	Quality
Poka-Yoko	Quality
VSM	Quality
Plant layout	Quality
Jidoka TPM	Quality
Heijunka/Takt time	Quality

Objective	Impact
Lead time reduction	High
Flexibility	Medium
Visibility/Traceability	Medium
Cost reduction	Medium
Quality	High