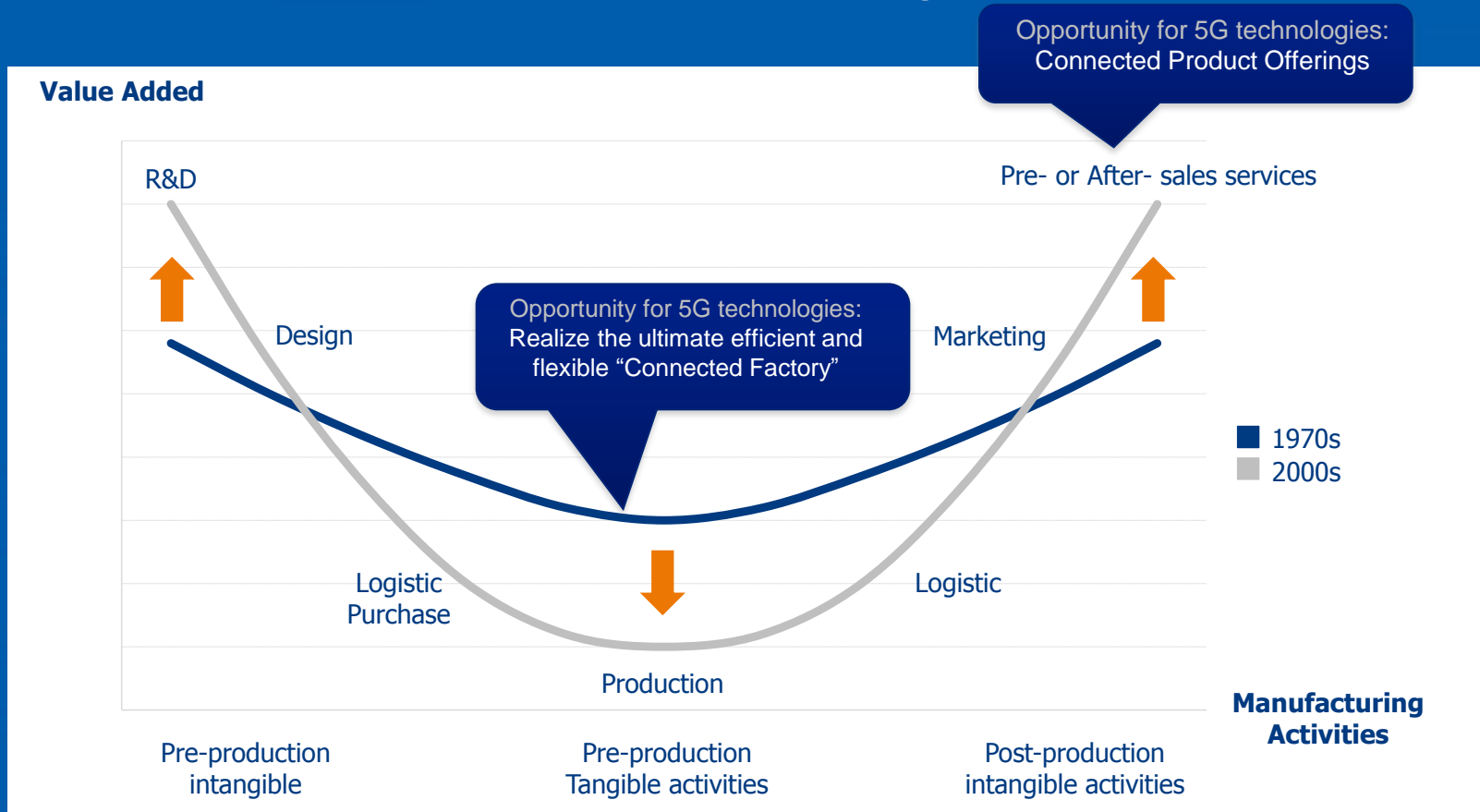
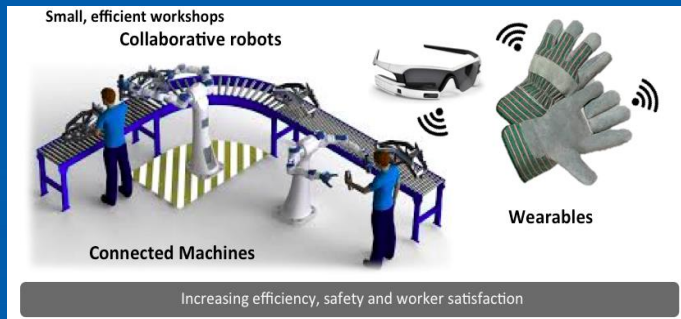


White paper 5G and Factory-of-the-Future

European businesses must focus on high value added activities



White paper 5G and Factory-of-the-Future



	Use case FAMILY	Representative SCENARIOS	Dominant IMPACT
Use case family 1	Time-critical process optimization inside factory	Real-time closed loop communication between machines to increase efficiency and flexibility.	Increased efficiency Increased worker satisfaction Increased safety/security
		3D augmented reality applications for training and maintenance	
		3D video-driven interaction between collaborative robots and humans	
Use case family 2	Non time-critical in-factory communication	Identification/tracing of objects/goods inside the factory	Increased efficiency Increased flexibility Minimized stock levels Increased eco-sustainability (emissions, vibrations, noise)
		Non-real-time sensor data capturing for process optimization	
		Data capturing for design, simulation and <u>forecasting</u> of new products and production processes	

Contributors

- ATOS, CEA, DOCOMOLAB, iMINDS, INNOVALIA, INTEL, MINES TELECOM, NOKIA, ORANGE, TECNALIA, TNO, TUD, ZABALA

White paper 5G and Factory-of-the-Future



Use case family 3	Remote control	Remote quality inspection/diagnostics	Increased product/process quality
		Remote virtual back office	
Use case family 4	Intra-/Inter-Enterprise Communication	Identification/Tracking of goods in the end-to-end value chain	Increased efficiency (cost, time)
		Reliable and secure interconnection of premises (intra-/inter-enterprise)	
		Exchanging data for simulation/design purposes	
Use case family 5	Connected goods	Connecting goods during product lifetime to monitor product characteristics, sense its surrounding context, and offering new data-driven services	Increasing sales (new products, services) Improved product/process design

Contributors

- ATOS, CEA, DOCOMOLAB, iMINDS, INNOVALIA, INTEL, MINES TELECOM, NOKIA, ORANGE, TECNALIA, TNO, TUD, ZABALA

White paper 5G and Factory-of-the-Future



Use case family 3	Remote control	Remote quality inspection/diagnostics	Increased product/process quality
		Remote virtual back office	
Use case family 4	Intra-/Inter-Enterprise Communication	Identification/Tracking of goods in the end-to-end value chain	Increased efficiency (cost, time)
		Reliable and secure interconnection of premises (intra-/inter-enterprise)	
		Exchanging data for simulation/design purposes	
Use case family 5	Connected goods	Connecting goods during product lifetime to monitor product characteristics, sense its surrounding context, and offering new data-driven services	Increasing sales (new products, services) Improved product/process design

Contributors

- ATOS, CEA, DOCOMOLAB, iMINDS, INNOVALIA, INTEL, MINES TELECOM, NOKIA, ORANGE, TECNALIA, TNO, TUD, ZABALA

White paper 5G and Factory-of-the-Future

Deterministic wireless industrial networking:

- Latencies up to 1ms

High level needs for the communication

Manage security & heterogeneity

		Latency	Reliability	Band width	Coverage Availability	Security	Heterogeneity	Autonomy
UC1	Time-critical optimization	Ultra-low	Ultra-high	Low to high	Indoor	Critical	Important	Less critical
UC2	Non-time critical control	Less critical	High	Low to high	Indoor + On-site outdoor	Critical	Important	Critical for location tracking
UC3	Remote control	Less critical	High	Low to high	Wide Area	Critical	Important	Less critical
UC4	Intra-/Inter-Enterprise Communication	Ultra-low to less critical	High	Low to high	Wide Area (on-site/ outdoor)	Critical	Important	Less critical
UC5	Connected Goods	Less critical	Low	Low	Wide Area	Important	Important	Critical

Coverage

White paper 5G and Factory-of-the-Future

Regarding the 5G roadmap and future research, we recommend focussing on:

- high factory throughput/output with research on ultra-reliable wireless deterministic communication
- high availability with research on proper security mechanisms and ubiquitous coverage and device to device traffic/service offloading mechanisms
- lowering the TCO with research on network capabilities to manage heterogeneity
- high flexibility with research on plug-and-produce capabilities by adopting internet technologies into industrial stacks
- new data-driven business models for SMEs and large companies, exploiting data-oriented services and network virtualization concepts
- changes needed with respect to legislative framework, standards and social acceptance
- building a specific strategy for 5G and manufacturing SMEs