

FIWARE Global Summit

Scale Up for a Real Smart Future

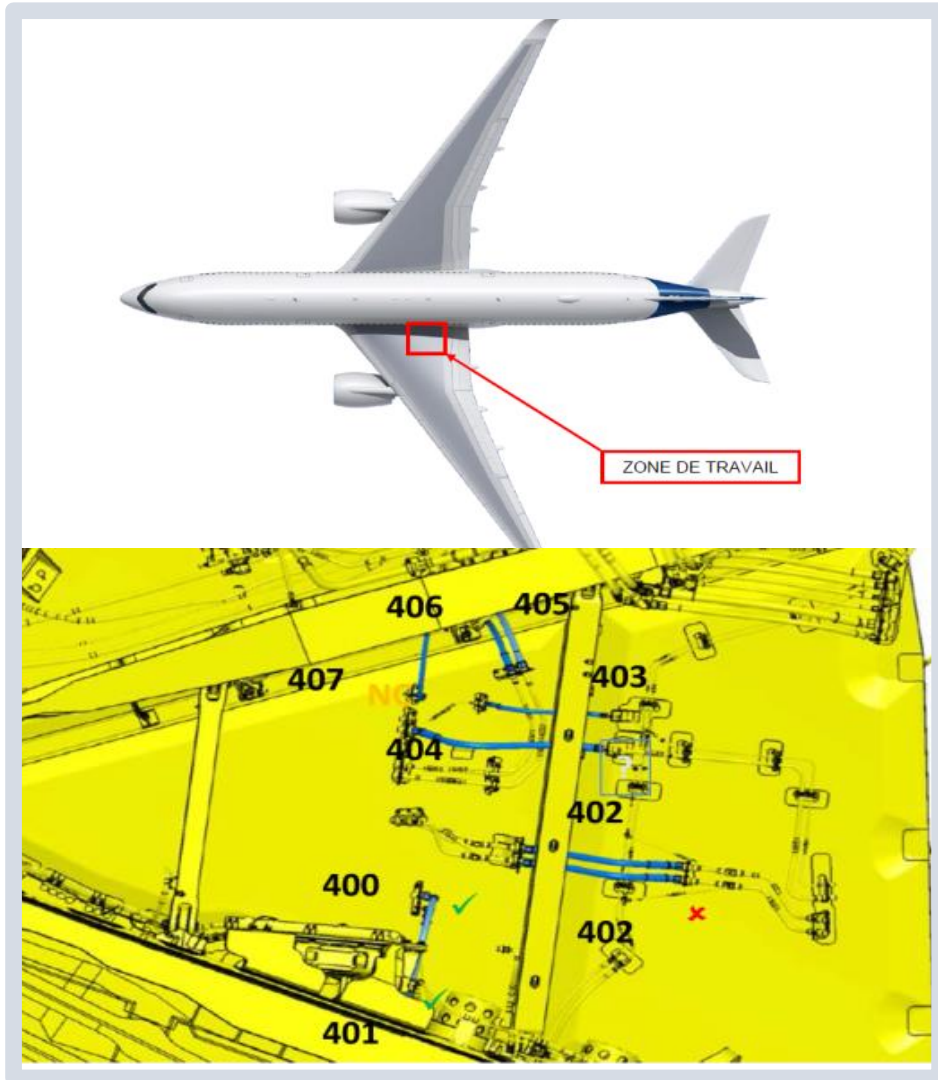
IMPLEMENTING HUMAN-CENTRIC MANUFACTURING WITH FIWARE

A4BLUE CASE - AIRBUS UC

Contact: Laure.pariqot@airbus.com

Berlin, Germany
23-24 October, 2019

AIRBUS Use Case – Scenario



Business case

- Towards a more optimized hydraulic system assembly on the A350 Over Wing Panel comprising various sets of operations including a lot of different parts to be installed in constraint positions through Automation and Virtual/Augmented Reality

Scenario

- **Actors:** Assembly Operator, Quality Supervisor, Metrology Supervisor
- **Automation Mechanism:** smart torque wrench
- **Interaction devices:** Hololens, Smartphone, PC.

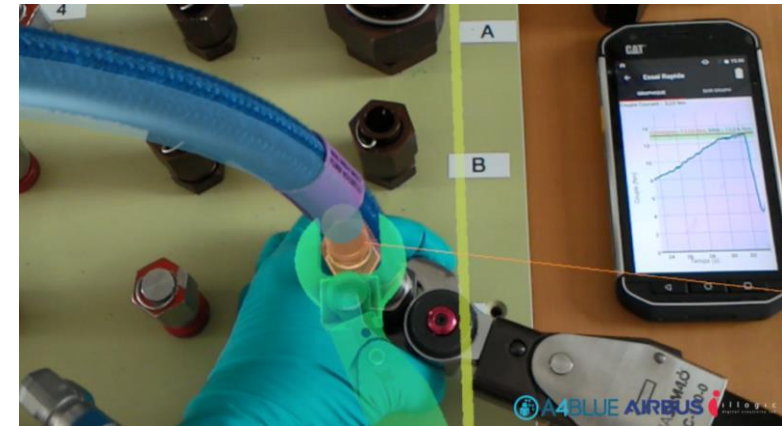
AIRBUS Use Case – Motivation & Challenges

Motivation

- To evaluate and measure the impact of an adapted AR HMI in term of performance and error rate.
- Enable real-time monitoring and synchronize automatically information.
- Enable Full Quality Assurance approach and Operators performance thanks to traceability

Challenges

- To provide adapted AR/VR based training and on the job guidance.
- To adapt, automatically, the parameters of the torque wrench.
- To provide assistance to the Quality Inspector to secure a full quality assurance approach.
- To provide assistance to the Metrology supervisor.



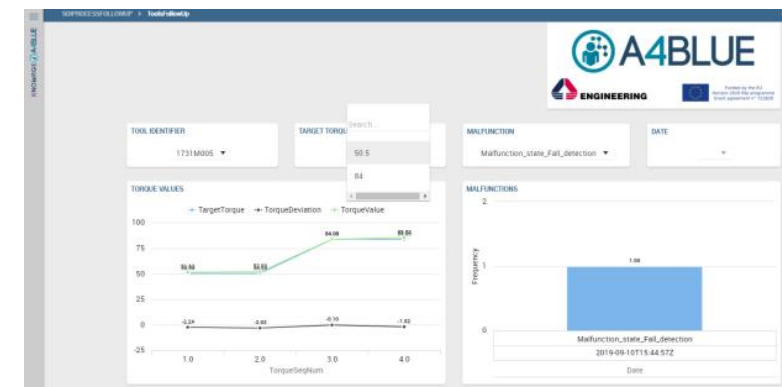
PROCESSFOLLOWUP > ProcessParametersFollowUp

JOBORDER

JO_soi001

PROCESSPARAMETERS FOLLOW UP

JobOrder	Operati...	Operati...	OperatorIdentifier	Process...	ToolIdentifier	RealValue	TargetValue	Deviation
JO_soi001	Prepar...	soi.001...	1.00	http://...	1731M005	51.30	50.50	-0.40
JO_soi001	Prepar...	soi.001...	1.00	http://...	1731M005	24.15	21.50	-0.57
JO_soi001	Prepar...	soi.001...	1.00	http://...	1731M005	44.95	21.50	-5.04



AIRBUS Use Case – Adapted AR/VR based training and guidance



Off the job training

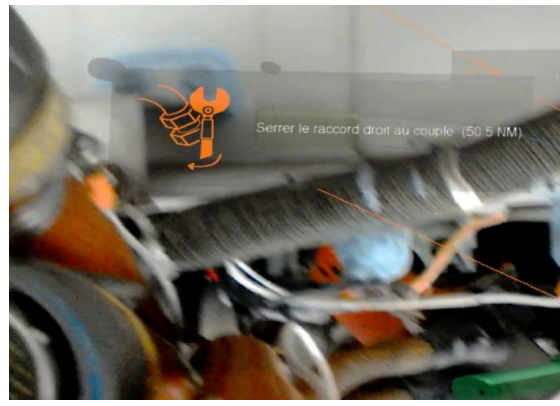
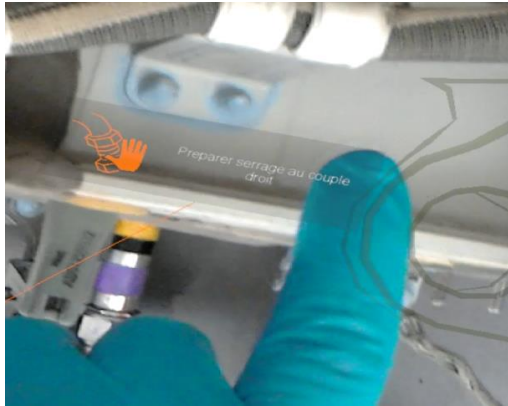
- AR/VR based off the job training using a mock-up for the hydraulic assembly.

On the job guidance

- On the job guidance adapted to both the specific worker and operation involved. Both the way the information is displayed to the workers and the AR device to display such information is considered
- The quality inspector access “read only mode” to supervise novice operators.

AIRBUS Use Case – Adapted process parameters

- A4BLUE supports the automatic adaptation of the parameters of the tools involved in the assembly process considering both the operation being performed and the related standard operating instructions.



AIRBUS Use Case – Assistance to Quality Inspector

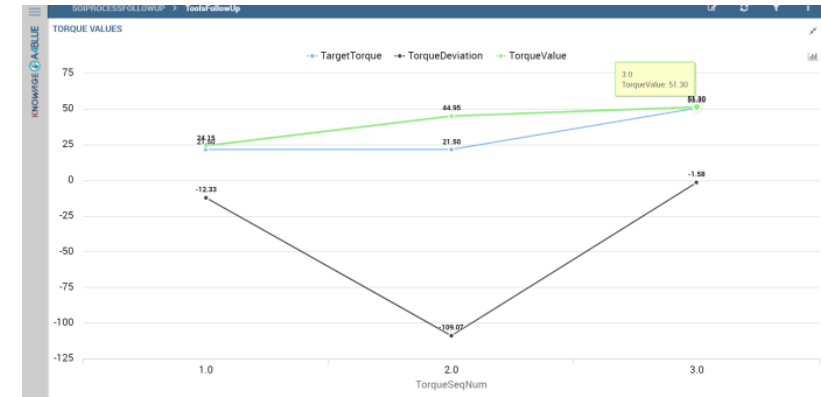
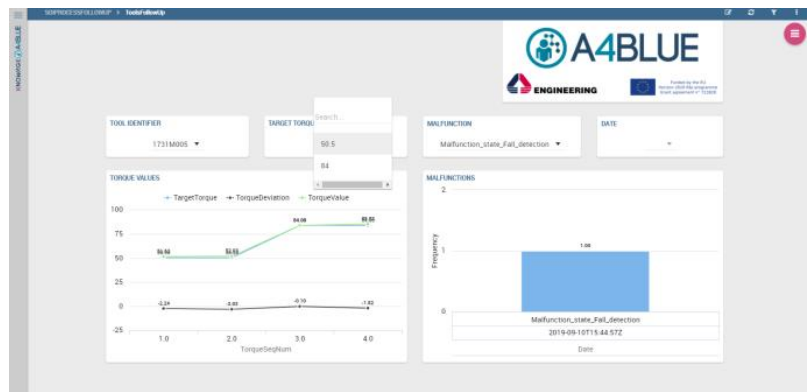
- Assisting the Quality Inspector to secure a full quality assurance approach by making available in-real time the information collected from the smart tools (not available in the current process) during the assembly; avoiding to manually control the executed task, ease the error detection and then correction, measure the realization time to ensure time and quality delivery.

SOI PROCESS FOLLOW UP						
JobOrder	OperationDescription	OperationID	Status ↑	StatusID	Timestamp	
JO_soi001	Preparer serrage au couple gauche soi.001-Task_01_04_00		Finished		2019-09-09T10:11:23Z	
JO_soi001	Preparer serrage au couple gauche soi.001-Task_03_04_00		Finished		2019-09-09T10:14:17Z	
JO_soi001	Preparer serrage au couple gauche soi.001-Task_05_04_00		Finished		2019-09-09T10:14:37Z	
JO_soi001	Serrer le raccord gauche au coup... soi.001-Task_03_04_01		Finished		2019-07-17T08:32:48Z	
JO_soi001	Serrer le raccord gauche au coup... soi.001-Task_05_04_01		Finished		2019-07-18T12:19:28Z	
JO_soi001	Serrer le raccord gauche au coup... soi.001-Task_01_04_01		Finished		2019-07-17T08:32:48Z	
JO_soi001	V<c3><a9>rifier tous les tuyaux	soi.001-Task_000_02	Finished		2019-07-17T08:32:13Z	
JO_soi001	De-serrer le raccord droit	soi.001-Task_01_05_02	Pending			
JO_soi001	De-serrer le raccord droit	soi.001-Task_02_05_02				
JO_soi001	De-serrer le raccord droit	soi.001-Task_03_05_02				

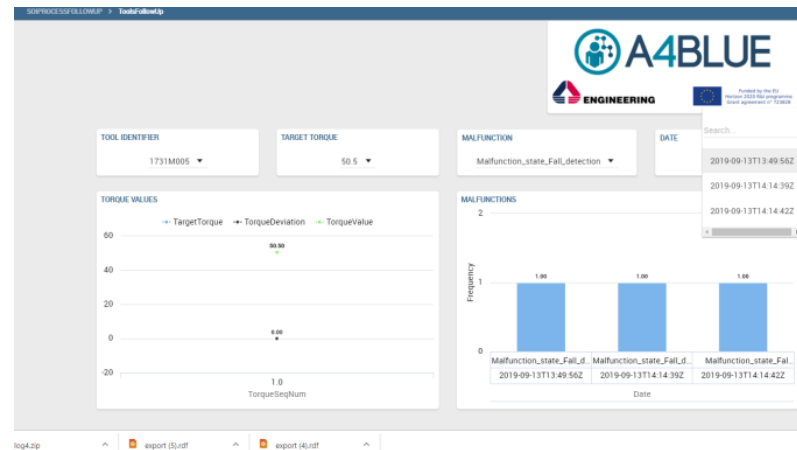
PROCESSPARAMETERS FOLLOW UP								
JobOrder	Operati...	Operati...	OperatorIdentifier	Process...	ToolIdentifier	RealValue	TargetValue	Deviation
JO_soi001	Prepar...	soi.001...	1.00	http://...	1731M005	51.30	50.50	-0.40
JO_soi001	Prepar...	soi.001...	1.00	http://...	1731M005	24.15	21.50	-0.57
JO_soi001	Prepar...	soi.001...	1.00	http://...	1731M005	44.95	21.50	-5.04

AIRBUS Use Case – Assistance to Metrology Supervisor

- Assisting to the metrology supervisor to:
 - measure the deviation on a tool to a dedicated torque value in time



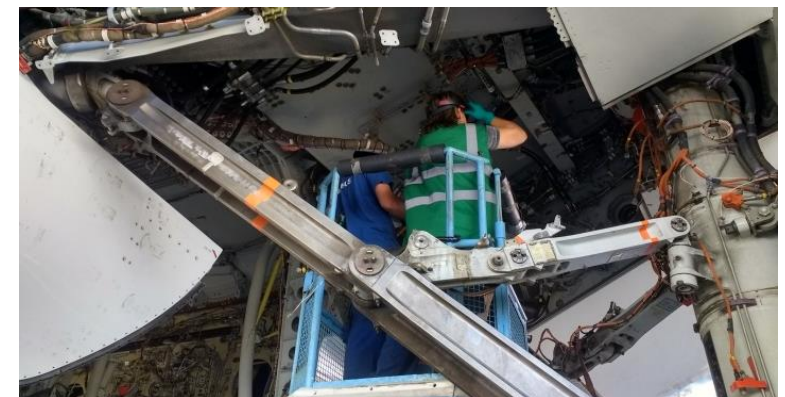
- detect in case of tool malfunction (test done on fall down detection)



AIRBUS Use Case – Global Video & Pictures

From the training to the production assembly ... to the quality inspection

Operator	Operation/Description	OperationID	Status	StartID	Timestamp
JL_sap001	Serrer le raccord gauche au couple (21 5 Nm)	sac001-Task_04_04_01	Pending		
JL_sap001	Serrer le raccord gauche au couple (21 5 Nm)	sac001-Task_04_04_01	Pending		
JL_sap001	Tapez 405 (485) (2717886421)	sac001-Task_04	Pending		
JL_sap001	Tapez 405 (485) (2717886421)	sac001-Task_04	Pending		
JL_sap001	Préparation générale des 3 supports pour l'essai	sac001-Task_05_00	Finished		2019-09-10T15:52:02
JL_sap001	Information serrage au couple	sac001-Task_05_01	Finished		2019-09-10T15:52:02
JL_sap001	Vérifier l'espace de travail	sac001-Task_05_01	Finished		2019-09-10T15:52:02
JL_sap001	Information de préparation	sac001-Task000	Finished		2019-09-10T15:52:02
JL_sap001	Vérifier tous les supports	sac001-Task_05_02	Finished		2019-09-10T15:52:02
JL_sap001	Tapez 405 (485) (2717886421)	sac001-Task_05_00	Finished		2019-09-10T15:52:02



AIRBUS Use Case – Evaluation

Protocol performed by 7 assembly operators (6 Male, and 1 Female with an average age of 28 years (SD:6.5)



Mock-up (off the job training)

- Brief explanation and consent
- Explanation of the smart tool use
- Explanation of the hololens gestures
- Brief on mockup purpose and pipe assembly as a success criteria
- Mockup trial & survey

Over Wing Panel assembly (on the job guidance & tool adaptation)

- Over Wing Panel trial explanation
- Assembly of, at least, one union of a pipe
- Survey on OWP trial.

AIRBUS Use Case – Evaluation- Some words during the trials



« It is great to participate to these trials, it changes from our daily life and it will come to us in a future ! »

Waiting in the elevator when job order was downloaded

« It is exactly that ! »

Speaking about the torque value set to the torque wrench

« No don't worry, it's worth spending time waiting, it's really interesting these new technologies, it will improve a lot things even if it is still research but it's good that it comes here

After one hour of technical troubles with network connection, IT troubles,

...

« Excellent ! »

When the torque wrench was automatically set to the release point

« Fun & Cool »

Enjoying the use of the smartool and the holo for the mockup and on OWP

AIRBUS Use Case – Evaluation: Usability and mental workload results



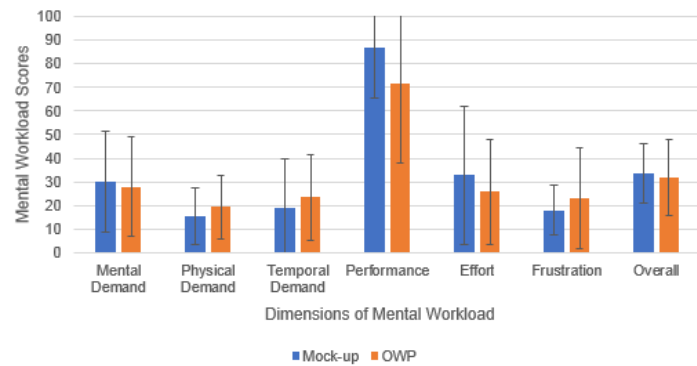
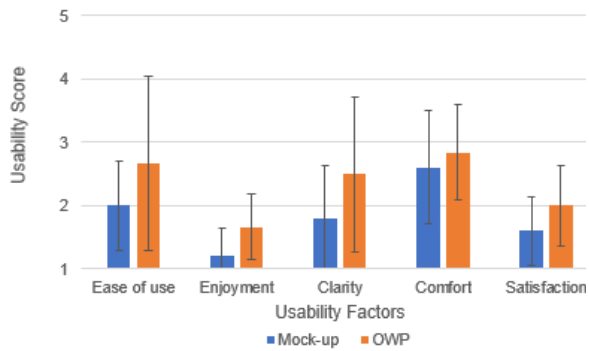
Usability and Mental Workload

- Good usability scores. Mock-up has better usability than the OWP results .
- Low mental workload scores with high performance scores indicates a level of under-loading potentially due to familiarity with the task

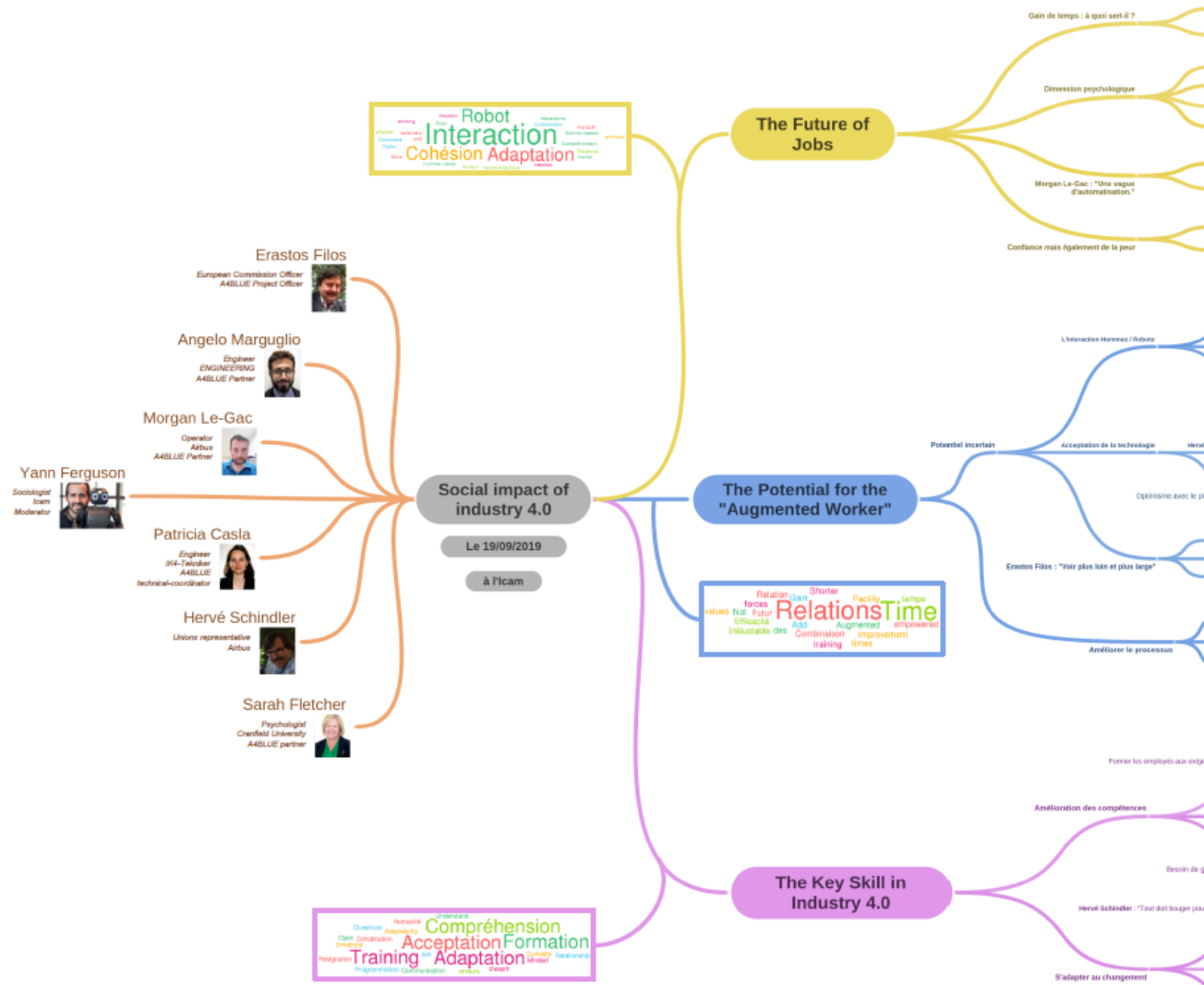


Benefit

- Improves **productivity** → reduce time used by the operator to look for information and to change tool
- Increases **traceability** → everything can be recorded, reported, including final signature of the tasks



AIRBUS Use Case – Social Impact on Industry 4.0



Debate figures

- Not only a technical assessment,
- A real questioning around the place of Human around this new industry
- Public debate on the social impact of the industry 4.0
- 3 questions
 - The future of the jobs
 - The potential for the « Augmented Worker »
 - The Key Skill in industry 4.0
- 6 panel members, 1 moderator
 - Sociologist moderator, European Commission Officer, Operator, Unions, Psychologist, Engineer, Engineer technical coordinator

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Acknowledgements;



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