INTERVIEW WITH RESEARCH TEAM OF ASSETS+ PROJECT

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Filippo CHIARELLO is an Assistant professor at the School of Engineering, University of Pisa. MEng and a PhD in Management Engineering (both "summa cum laude") at the University of Pisa. His research focuses on the use of Natural Language Processing techniques for studying technological and HR-related phenomena. He also has a wide experience in patent and scientific papers automatic analysis and technology foresight. His publications include more than 50 peer-reviewed papers, including international journals like IEEE Transactions in Engineering Management, Technological Forecasting and Social Change and Expert Systems with Applications. For ASSETs+ he is the leader of WP1 "Technology and Skill Analysis", dedicated to map technological evolution in Defence and study the impact of emerging technologies on skills and job profiles.

What are the major missions and main research topics of ASSETs+?

 [Fantoni] ASSETs+ aims to build a sustainable human resources supply chain for the European Defence Industry, that boosts innovation by both attracting highly skilled young workers and upskilling its employees. The fast pace of technological evolution leads to challenges in terms of finding workers with the right skills, as these are constantly changing. Our goals are exploring and foreseeing emerging trends in technologies and skills in the Defence sector, translating the results into concrete concepts as a basis for new education and training programs and developing a European Defence Qualification System covering pedagogical and technical aspects while complying with education requirements and industrial needs. The main research topic of the project is the impact of

the digitalization on the human resources, focusing on the cutting-edge technologies of Artificial Intelligence, Robotics, C4ISTAR[1] and Cybersecurity.

We live in a world that's constantly changing. So, how to deal with this challenge in foresight analysis in future technological trends and skills' needs?

[Chiarello] The fast technological evolution makes difficult to properly delineate and address its impact in the labour market and in education. Moreover, a complete understanding in such a complex domain like Defence (where the confidentiality of the information is critical) is challenging. The ASSETs+ approach,.

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[1] *C4ISTAR is an acronym for Command, Control, Communications, Computers, Information/Intelligence, Surveillance, Targeting Acquisition and Reconnaissance*

leveraging both on qualitative and quantitative techniques and methods, is a feasible way to have near real time monitoring. Big data analysis allowed us to delineate the Defence landscape within the emerging technological domains. Brainstorming sessions with panels of industrial experts lead us to a deeper comprehension of the facets of this complex environment, fostering the possible interrelations among those cutting-edge technologies, the implication on well-suited competences and soft skills, and the good practices to deploy at the organizational level as well as on the regulatory one.

What are the main research directions of the cutting-edge technologies in the Defence areas?

[Chiarello] Research in Defence will be more and more synergic with Civil domains, due to the widespread utilization of emerging and disruptive devices and applications. Defence sector is historically an innovation intensive and knowledge intensive sector. In the last two decades, the innovation paradigm has radically changed, due to the development, within the civil domains, of several disruptive technologies such as Artificial Intelligence and Robotics. Indeed, new spaces of complementarity and collaboration are opening, such as security, mobility, health, information management, cyber and space. In near future, research will focus on autonomous systems and their interaction with human workers in Cyber Physical Systems. Then, we need to develop new strategies and approaches for security issues. A promising area of development will be the integration of AI applications to execute cybersecurity tasks. Finally, R&D projects and programs will be centred on data fusion, to effectively harmonize the great amount of data obtainable near in real-time, and on high performance computing systems, such as Quantum

Computing and Fog Computing, to process the data at a reasonable speed.

For next decade, the AI technologies will be the driving forces for future intelligent systems. How do you think European agencies and companies will deal with the ethical and legal aspects of using these technologies in Defence operations?

[Chiarello] We need an internationally shared regulation to deal with the ethical and legal aspects of Artificial Intelligent applications. It is essential to study the behaviour of the algorithm and the logical structure behind the model. The aim is having explainable and testable AI algorithms, to release a certification of the products and procedures. The reliability of AI technologies, particularly to the tactical edge, is strictly related to the FAIR principles for data management (findability, accessibility, interoperability, and reusability). Therefore, future generations of data scientists and machine learning specialists must be aware and apply strategies to mitigate the negative effects of the biases and develop data and AI trustworthiness certification procedure to ensure the robustness of methods and results.

The fast pace of technological evolution is radically changing the labour market. What the impact on skills and job profiles in the context of Defence?

[Chiarello] There is an urgent need of training programmes aligned with current and future technological requirements and a Qualification system based on the best practices in the European Defence industry. Design educational content for the workforce of the near future is essential to keep the pace of technological evolution, anticipating the trends and not just adapting to. Defence sector needs of managerial skills to ensure flexibility, and a collaborative management to promote the synergic integration across different industries. The high-speed and tangled technological development make multidisciplinary fundamental to manage changes and the unsteady direction of innovation mechanisms, together with the ability to collaborate will be key competences for emerging challenges. Finally, workers need analytical skills and cognitive capabilities to manage and process the data collected by the information systems, analysing and evaluating information for the situational awareness.

How can ASSETs+ address digital and transversal skills in the design of E&T Programmes?

[Fantoni] Beside the technical skills, ASSETs+ is also designing and developing courses and programs for data-driven projects and processes management. We have analysed the trend of the phenomenon in the scientific and grey literature, and it seems that there are relevant converging signals towards the figure of the data-driven project manager. This professional profile uses data and information of various types and formats to plan and monitor processes, support decision making, elaborate solutions for problems, and manage complex projects. This figure will be more and more important because we are moving from a single-objective design (typically the cost) to projects that aim to meet several objectives at the same time (i.e., innovation, sustainability, and efficiency). The ambidexterity therefore become a key capability to address in the design of E&T programs especially in the domain of Defence (and Aerospace) as a driving force in digital transformation.

Covid-19 pandemic accelerated the time for a reconstruction of the educational systems, pushing towards a faster digitalization of the service. What is the impact on the design of education and training activities?

[Fantoni] Covid-19 pandemic has pushed through a faster digitalization of education and online learning, causing a disruption in education systems. The traditional face-to-face lectures have inevitably moved online. This implied problems and difficulties in reproducing the same activities in digital environment. However, this situation also proved the feasibility of online training on large scale. New possibilities are opening, especially for reskilling and upskilling activities dedicated to current workers: they typically had to deal with time and location constrains in selecting and attending courses, while they can achieve much more flexibility and can access a lot of educational resources. Nowadays, educational institutions evaluate if the blended or distance mode can be adopted in each learning environment, while just

few years ago this possibility was just not considered. A big challenge for the the design of education and training activities concerns with the level of detail of the program. The largest e-learning providers usually provide fragmented courses, very focused on single topics or skills. Their offers lack broader courses and training activities, that provide a general overview on the connection among the addressed competences and knowledge. Indeed, these have always been carried out in face-to-face mode. But the experiences deriving from Covid-19 have shown that this learning experience can also be realized online. We need to constantly monitor the labor market to find the match between the needs of companies and the training offers and fill in the skills gaps of current and future workforce.

Defence is facing difficulties in attracting young students. What is the ASSETs+ strategy for this problem?

[Fantoni] European Defence industry is struggling in finding well-suited workers to ensure leadership, competitiveness, and sustainability in the medium- to long-term on the international panorama. In addition, young generations are not engaged in Defence issues and usually don't see careers in Defence as promising opportunity. Therefore, Defence companies should develop new strategies to attract and keep young talented workers. There are many prejudices about Defence activities, however this industry is always at the frontiers of innovation offering the more advanced technologies and a very international and multidisciplinary environment. We are working to explode the myths and biases around the Defence sector and are designing new courses and challenges able to attract students' attention. A concrete initiative implemented within ASSETs+ project is the European Defence Challenge (https://assets-plus.eu/challenge/), an open competition to

attract young talent to the Defence industry and to encourage them to initiate a career in defence-related technologies. All undergraduate or graduate students from all faculties in European Universities, vocational education and training centres can participate with an essay of a given topic, based on the needs and the challenge of the Defence sector as resulted by the analysis of our project.

How to promote European collaborative upskilling and reskilling initiatives in response to the skills needs of the Defence industry?

[Fantoni] The fast technological evolution discussed above is even more challenging in an international perspective where the collaboration among different actors and stakeholders is fundamental to avoid duplication of efforts. We need new processes and mechanisms and common policies to smooth the collaboration across Defence and Civil sectors. It is important not only having advanced technologies, but above of highly skilled employees to use the advanced technologies and carry-on cutting-edge research. Our goal is to develop demand-led upskilling and reskilling training programmes on the cutting-edge technologies. The strong collaboration among the actors in our Consortium (that encompasses Defence Industry, sectoral organisations, HEIs, VET providers and research centres from 8 different EU countries) will contribute to strengthen coordination between government, industry, and education & training. We are working on developing a sustainable strategy for developing HR in the Defence Sector based on 6 pillars, namely qualifications, policies, project & funds, technologies, human resources, technical standards, and best practices.