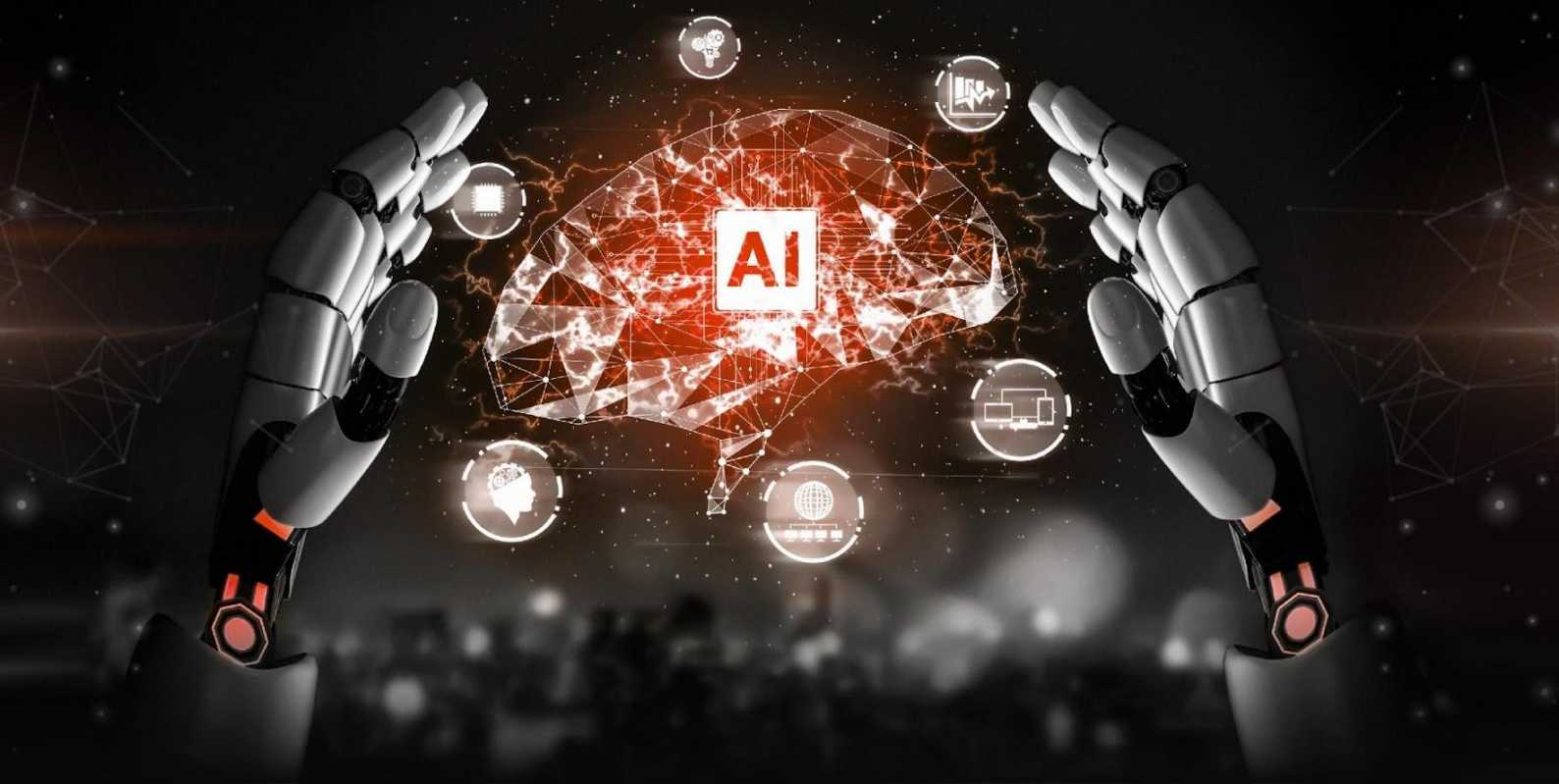


Interview Guide



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Interview guide

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AGIMUS in a nutshell

AGIMUS aims to deliver open-source breakthrough innovation in AI-powered agile production, introducing solutions that push the limits of perception, planning, and control in robotics, enabling general-purpose robots to be quick to set up, autonomous and easily adaptable to changes in the manufacturing process.

To achieve such agile production, AGIMUS leverages cutting-edge technologies and goes beyond the state-of-the-art to equip current mobile manipulators with a combination of (i) an advanced task and motion planner that can learn from online available video demonstrations; (ii) optimal control policies obtained from advances in reinforcement learning based on efficient differentiable physics simulations of the manufacturing process; as well as (iii) advanced perception algorithms able to handle objects and situations unseen during initial training. Along the way, optimising energy efficiency and using 5G technology will support further pushing the limits of autonomy.

The AGIMUS solutions and their impact will be demonstrated and thoroughly stress tested in 3 testing zones, as well as 3 industrial pilots in Europe, under numerous diverse real-world case studies and scenarios (different tools, environments, processes, etc.). In every step, and from the very beginning, AGIMUS will go beyond current norms and involve a wide range of stakeholders, starting from the production line itself, to identify the essential ethical-by-design principles and guidelines that can maximise acceptance and impact.

Scope of the analysis

Based on the ongoing desk research, a deep dive into the versatile robotics for agile production paradigm, understanding in more detail the needs, challenges & requirements of manufacturing lines that have adopted or need such principles was endeavoured.

Our aim is to shed light on (i) agile production as a new trend, (ii) its industrial needs and challenges, (iii) available or forthcoming technological solutions such as versatile robotics, (iv) key actors (industry, policy and research arena), (v) openly available resources for extending research activities, uncover barriers and drivers across key framework conditions which may influence uptake in the shop floor (e.g. culture, access to properly skilled human capital, regulations, policy support, etc.).

To gain the necessary knowledge more effectively, semi-structured interviews will be performed with key experts in AI, Data, Robotics, and Manufacturing from AGIMUS industrial partners and external stakeholders. The workforce from the AGIMUS industrial pilots and external key stakeholders will be actively involved towards better understanding their needs, concerns and acceptance barriers. Potential interviewees will also include people involved in the shop floors, following recent research insights that suggest that active workforce involvement during the design phase (i.e., drawing on the workers' knowledge) can lead to not only better productivity results, as they have the required knowledge for the details, but also higher acceptance rates for production robotics.

The objective of the interviews

The main target of the interviewing activities is to offer profound insights to AGIMUS, allowing a more accurate and high-performance design of the envisioned autonomous robotic solution, but also to introduce major long-term impact to the shop floor such as an increase in productivity, reduction in deficits and waste of materials and high acceptance rates.

By actively involving key stakeholders across the “AI, data and Robotics” supply chain through interviews (and surveys later on), a concrete foundation will be created on the actual needs and potential of improved perception and understanding of an agile production line that uses versatile robots, while working safely at the same shopfloor with workers, without or with limited supervision.

These findings will support implementation through a shopfloor-driven, user-centred approach, ensure increased autonomy and an arsenal of augmented capabilities for safe and efficient manufacturing processes.

During the interviews, any openly available platforms, databases, datasets, etc., that can bring value during the implementation phase will be documented. The valuable feedback of the interviewees will enable us to identify any dimensions not previously envisaged and fuel the development of a questionnaire to be administered to a broader group of experts, including the employees of AGIMUS’ 3 industrial pilots. This questionnaire will cross-reference findings and reveal disparity points that may require further investigation.

Ultimately, interviews will help us define certain requirements that will be transformed into specific functional and non-functional (social, privacy, etc.) technical requirements of AGIMUS system architecture.

To summarise, the interviews’ objectives are:

1. Extract insights to validate, complete or even correct the ongoing desk research and literature review (iterative process);
2. Enhance the knowledge provided by key stakeholders across the “AI, data and Robotics” supply chain to support the design of the questionnaire survey that will follow later, giving insights on the topics that should be covered by it and people that should be reached;
3. Elucidate issues that may arise in AGIMUS industrial pilot cases, take them into account and potentially prevent them;
4. Shed light on various aspects of robotic-driven agile production, such as business, economics, technology, management and ethics, from the viewpoint of all involved stakeholders, i.e., workers, managers/experts, and decision takers;
5. Inform the main aspects and parameters that should be considered for AGIMUS system requirements and architecture;

QUESTIONNAIRE

General information of the interviewee

	INTERVIEWEE'S PROFILE		
Demographics	Age range	Gender	Education
	30-40	Male	Telecommunications Engineering, PhD
Organisation type	<i>Research and Technology Organisation (RTO)</i>		
Positioning in the organisation	Head of Flexible Manufacturing Robotics		
Level of expertise in robotics	HIGH		
Level of experience in production (agile or otherwise)	HIGH		
Country	Spain		

The interviewees may be experts, executive officers, managers or workers. The questions that will be posed may differ slightly according to the respective target group. All notes may be kept in the area that is foreseen after each question below. If need be, the transcripts should be translated into English before being delivered to Q-PLAN.

Questions

No	Interview's topics/questions	Notes for interviewers (to activate/trigger the dialogue, or give some hints, explanations, or examples)
1	<p>What is the definition you would give on agile production?</p>	<p>Guide the interviewee if his/her definition is ambiguous.</p> <p>Indicative definition:</p> <p><i>“Agile production is a term applied to an organization that has created the processes, tools, and training to enable it to respond quickly to customer needs and market changes while still controlling costs and quality. It is seen as the next step after lean manufacturing in the evolution of production methodology.”</i></p> <p>Agile production is understood as a paradigm that aims to have easily reconfigurable production means to answer to “high mix low volume” type of market demands.</p>
2	<p>How do you envision versatile robotics could address the agile production line needs?</p>	<p>Indicative definition:</p> <p><i>“Versatile robotics are robotic systems able to quickly adjust and adapt to many different functions, activities or changes, causing minimum interruption to the production process.”</i></p> <p>Versatile robotics is a key element of agile production environments since it represents robots that can easily adapt to changes in production needs. However, traditional robots by themselves do not have this level of adaptability. Robots, paired with advanced perceptions systems and sophisticated software that can interpret and act accordingly is what we understand is versatile robotics.</p>
3	<p>Are you aware of any versatile robotics solutions for agile production?</p> <p>Are you aware of any available or forthcoming technological solutions for agile production?</p>	<p>Goal: to find out about the competition</p> <p>e.g., advanced perception algorithms, Task-And-Motion</p>

No	Interview's topics/questions	Notes for interviewers <i>(to activate/trigger the dialogue, or give some hints, explanations, or examples)</i>
		Planner, Cloud systems and Internet of Things
4	<p>Which are the 5 most important needs of agile production lines in your opinion? Why? Does the use of versatile robotics create more/different needs? Why?</p> <p>Over the last years commercial solutions have been presented to address these challenges. The recently presented D:Ploy from OnRobot (https://onrobot.com/es/soluciones/dploy) is a clear example.</p> <p>Most important needs of agile production:</p> <ul style="list-style-type: none"> - Advanced perception systems to have the ability of getting a 3D representation and understanding of the scene. - Mobile robotics to be able to have reconfigurable layouts, smart logistics... - Easy programming interfaces to empower non-expert users and allow them to reconfigure production. - Artificial Intelligence applied to robotics to have systems that can learn from past executions or adapt automatically to new references of products. - Collaborative robotics that allow the systems to work next to operators and not behind fences. 	-
5	<p>What kind of technologies were you using instead of robotics? When did you first use robotic systems? What kind of robotics did you use?</p> <p>Before robotics, automated systems with rigid actuators were used. This type of production was then addressed by industrial robots that can reach high production levels in a very repetitive environment. This type of production is now shifting to collaborative and versatile robotic systems that can be easily reconfigured and work along human operators. In my personal experience, I have always worked with robots.</p>	-
6	<p>Which were/are the most important drivers of implementing agile production in general and versatile robotics in particular? Why?</p> <p>The need of companies to have production means that can be easily reconfigured when production needs change. Non agile production models are justified when very long series will be produced, since the investment requirements can be absorbed in the cost of the produced goods. When the volume of one single product is low, agile production allows to absorb investments along a larger variety of products.</p>	e.g., Industry, customers' requirements, infrastructure, government policies, company interests, other
7	<p>How were technology changes in your production process seen by the employees? What allowed them to</p>	-

No	Interview's topics/questions	Notes for interviewers <i>(to activate/trigger the dialogue, or give some hints, explanations, or examples)</i>
	<p>take place? What did perhaps decelerate/accelerate their progress or reduce/increase their acceptance?</p>	
8	<p>Do you have in mind any measurable changes depicting the impact of introducing agile production methods in general and the use of versatile robotics in particular?</p>	<p>with respect to productivity, efficiency, quality, profit, other</p>
	<p>Which are the 5 most important challenges that agile production lines face in your opinion? Why?</p> <p>Does the use of versatile robotics create more/different challenges? Why?</p>	<p>e.g., culture, access to properly skilled human capital, technology, regulations, policy support</p> <p>e.g., excessive deployment time, maintenance, costs, any other particularity</p>
9	<p>Most important challenges:</p> <ul style="list-style-type: none"> - Ability to make agile production tools accessible to workers. - Convince society that automatization and robotization is the only way to survive and stay competitive at an international level. - Educate the young population in these new technologies. - Adapt current factories to allow the installation of these new technologies. - High initial cost of these types of tools, even if these investments are profitable in the mid-term. 	
10	<p>To which extend are AI-powered solutions beneficial for the employees? Which employee category do you expect to oppose to the deployment of AI-powered solutions?</p>	<p>e.g., impact on the work life quality, specialized training and abilities may be needed in order to integrate robots in the production line and work with them, patiently teaching a robot</p>

No	Interview's topics/questions	Notes for interviewers (to activate/trigger the dialogue, or give some hints, explanations, or examples)
	<p>AI-powered solutions might improve working conditions for workers addressing arduous tasks. For instance, welding operations in shipyards are highly manual operations since they require the expertise and know-how of expert workers that know how to address a great deal of different situations. A versatile AI-powered robotized welding solution that can be guided by human operators might improve their working conditions.</p> <p>Shopfloor workers in industries that make use of a lot of people and trade unions.</p>	<p>how to carry out repetitive tasks may be required</p>
11	<p>What would you consider as sufficient guarantee regarding the responsibility and accountability of an AI-powered solution, before integrating it into the production line?</p>	<p>e.g., performance metrics; safety guarantee about the behavior of the robot; explicability of the robot behavior (for example displayed on an external screen or leading to interpretable movements); safety measures in case of failure; time-to-reset metrics</p> <p>The fact that the application is validated in a representative setup with a lot of variants to make sure that solution has been correctly tested.</p>
12	<p>How reliable do you consider AI-powered compared to classical engineering-based solutions? How reliable would you like an AI-powered solution to be in order to consider integrating it or replacing your current solution?</p>	<p>The interviewee should provide a quantitative metric (e.g., the success rate regarding a specific task) if possible</p> <p>It depends on the type of AI we consider. AI approaches to process visual information have known an incredible evolution over the past years and are now reliable for some tasks such as segmentation or identification. Other AI approaches such as deep reinforcement learning or teaching by demonstration applied to robotics are still not mature enough to replace more traditional control techniques.</p>
13	<p>Have you considered the environmental & energy cost of deploying AI-powered solutions to your company/organisation? If you are already using AI-powered solutions, have you considered using more efficient algorithms to reduce the environmental impact?</p>	<p>e.g., energy consumption, type of energy used by the data centres, hidden costs of cloud-based solutions</p>

No	Interview's topics/questions	Notes for interviewers (to activate/trigger the dialogue, or give some hints, explanations, or examples)
	Not really.	
14	<p>There are concerns that AI-powered solutions, such as versatile autonomous robots, will replace workers. What is your point of view and which do you consider to be an ethical approach to this deployment?</p> <p>I consider that robotization is the only way to stay competitive at an international level, and it is an incredible opportunity for Europe to bring back some production from Asian countries.</p>	-
15	<p>AGIMUS' framework results are expected to be the foundation of an open-source, international, robotics software consortium. What kind of benefits would your company/organisation expect to participate in it?</p> <p>To participate in it this framework should demonstrate its applicability in real production environments and not only in laboratory mock-ups.</p>	-
16	<p>What issues do you expect to arise with the broad use of cloud applications and 5G for online & offline training of an AI-powered solution?</p> <p>There might be confidentiality and privacy issues due to the need of uploading real data from manufacturing companies to external servers, for instance to third party stakeholders.</p>	-
17	<p>From the 7 key requirements defined by the EU ethics guidelines for trustworthy AI, which do you consider to be the most important? Please elaborate how this could be applied in the case of versatile robotics for agile production.</p>	<p>EU ethics guidelines for trustworthy AI key requirements:</p> <ol style="list-style-type: none"> 1. Human agency and oversight 2. Technical robustness and safety

No	Interview's topics/questions	Notes for interviewers <i>(to activate/trigger the dialogue, or give some hints, explanations, or examples)</i>
		<ul style="list-style-type: none"> 3. Privacy and data governance 4. Transparency 5. Diversity, non-discrimination and fairness 6. Societal and environmental wellbeing 7. Accountability
	<p>“Technical robustness and safety” and “accountability”. These types of solutions must be very well tested and validated to guarantee that the solutions are safe for the humans working alongside these technologies in the shopfloor. In the case an accident happens, it must be clear who is responsible for what.</p>	
18	<p>Would you consider any additional aspect of agile production & implementation of versatile autonomous robotics that we did not manage to address?</p>	<p>Goal: to check the completeness of the questionnaire & make adjustments; to receive feedback on aspects not covered</p>
	-	