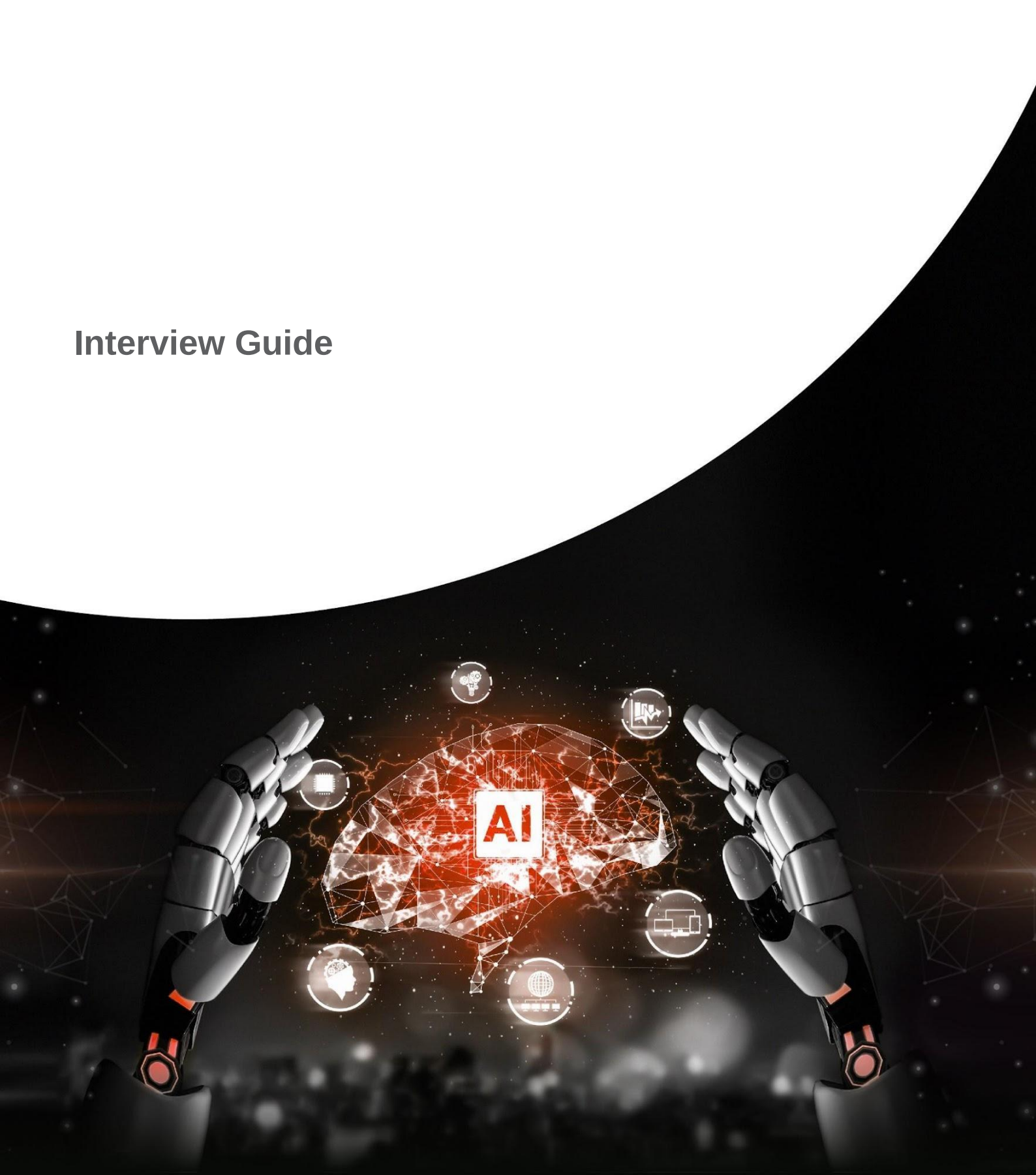
# Interview Guide

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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** | **Engineer** |
| | 60-70 | Male | *studies or vocational training, scientific expertise* |
| ***Organisation type*** | *RTO* | | |
| ***Positioning in the organisation*** | Senior Researcher | | |
| ***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 | **What is the definition you would give on agile production?** | Guide the interviewee if his/her definition is ambiguous.<br><br>Indicative definition:<br><br>*"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."* |
| | Agile production is the ability to adapt quickly to market requirements or product changes. It means that the system has to be designed as SW-based as possible to allow this ability to change. | |
| 2 | **How do you envision versatile robotics could address the agile production line needs?** | Indicative definition:<br><br>"*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.*" |
| | For a robot to be versatile, it is important that it has a sufficiently extensive set of tools, with an easy configuration that can be changed quickly every time the production needs change. | |
| 3 | **Are you aware of any versatile robotics solutions for agile production?**<br><br>**Are you aware of any available or forthcoming technological solutions for agile production?** | Goal: to find out about the competition<br><br>e.g., advanced perception algorithms, Task-And-Motion |

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| | | Planner, Cloud systems and Internet of Things |
| | KUKA modular system for agile production (AMR with robotic arms, end effectors, …), already commercialized (universal cells, no established navigation). | |
| 4 | **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?** | - |
| | Needs:<br>- ease in the change od the production process<br>- not linked to the process but toa set of universal tools<br>- independent from the configuration of the robots although they are heterogeneous (in SW and HW);<br>- flexibility in the equipment feeding routes (flexible path, with a flexible manufacturing sequence according to the capacity of the line),<br>- much more sophisticated line control system to guarantee flexibility (challenges). | |
| 5 | **What kind of technologies were you using instead of robotics? When did you first use robotic systems? What kind of robotics did you use?** | - |
| | The only reason why it not necessary to use robots in the manufacturing line, is when the process requires very short cycle times (--> specific machines). If you want flexibility and agility collaborative robots are the only option. | |
| 6 | **Which were/are the most important drivers of implementing agile production in general and versatile robotics in particular? Why?** | e.g., Industry, customers' requirements, infrastructure, government policies, company interests, other |
| | The most important driver is the market, which forces you to change the product and customise, users are willing to pay more to have customisation. This customisation can only be done with the adaptability and flexibility of robots, this is the trend.<br><br>Production change and customisation, responding to the market. | |

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|---|---|---|
| 7 | **How were technology changes in your production process seen by the employees? What allowed them to take place? What did perhaps decelerate/accelerate their progress or reduce/increase their acceptance?** | - |
| | Increased flexibility goes directly against the use of manual workforce. But robots are good at repetitive and easy-to-do tasks, and people should do more creative and non-repetitive work. The perception is currently not positive, but in the long run it will become more positive as the generations of workers will change. That is, in the short term the acceptance will be limited, but in the medium term there will be a full acceptance of robotics solutions.<br><br>Collaborative robotics is the way to make people accept robotics, accepting that the robot works for you, not alone, but the reality today is the other way around (the worker works for the robot), the robot does the easy task and the worker does the difficult onen, so when it fails the workers must take actions to unblock the process . When robots become more capable, there is no need for them to be collaborative.<br><br>In general, people have to do the creative tasks (sensitive, artistic, ...). | |
| 8 | **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?** | with respect to productivity, efficiency, quality, profit, other |
| | Economic parameters: companies that base their production agile production have to be more competitive because they respond to the market more quickly, they can charge more by being able to make more customised products (compared to mass production), and give more value to the product.<br><br>Resilience: companies that base their production in agile production are more resilient; if an external effect comes along that changes the conditions, you can adapt and you can react. Companies that need a high inversion to makle changes in their production line cannot survive easly. | |
| 9 | **Which are the 5 most important challenges that agile production lines face in your opinion? Why?**<br><br>**Does the use of versatile robotics create more/different challenges? Why?** | e.g., culture, access to properly skilled human capital, technology, regulations, policy support<br><br>e.g., excessive deployment time, maintenance, costs, any other particularity |

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|---|---|---|
| | The skills of people must be transferred more and more to robots.<br><br>A necessary skill that has to appear is that people can give these skills to the robot, interacting with the AI to give instructions.<br><br>Challenge: to manage flexible production systems, the complexity is to be taken into account, also when it is running, not only to program it, to make changes efficiently in order not to lose productivity. | |
| 10 | **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 solution?** | 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 how to carry out repetitive tasks may be required |
| | Who benefits: all decision-makers should benefit from AI, considering that the decision-makers have the  the last word and responsibility in the decision process.<br><br>Opponents: those who will not have the final word and that AI will automatically replace. Opponents by default: people with fear of change. | |
| 11 | **What would you consider as sufficient guarantee regarding the responsibility and accountability of an AI-powered solution, before integrating it into the production line?** | 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 |
| | The most important thing is that the AI is supervised by people, if there is a critical issue it always has to be supported → the person has to understand very well why and how the AI has made this decision (for example: in a fwe years it will be forbidden to people to drive because autonomous cars are more reliable). | |

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|---|---|---|
| | In this first phase AI must always be supervised, then we will see. | |
| 12 | **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?** | The interviewee should provide a quantitative metric (e.g., the success rate regarding a specific task) if possible |
| | AIs are probabilistic, you don't know for sure if the results are better or worse, you can't prove the quality of the solution taken. Standard solutions are based on measurable results. With this premises, the problems that can be tackled with the AI are for example the ones where you don't have the complete hypothesis and information (you have not fully verified data and you have to take a decision). | |
| 13 | **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?** | e.g., energy consumption, type of energy used by the data centres, hidden costs of cloud-based solutions |
| | People are more efficient and more "energy saving" when making decisions compared to AI. But for example cloud systems are more efficient than local systems → the energy needed to make the decision remotely is less than incase of decisions processed locally.<br><br>We need to find out if digitised systems are more efficient than people in the decision making. At the moment we do not know. | |
| 14 | **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?** | - |
| | Robots are going to do the jobs that are not creative, repetitive-heavy-dangerous -- so any job with these characteristics can be replaced by robots and it's a good thing in general. The problem is relocating these people to another job, and this is complicated. The benefits that robotics and AI bring to society or business should be redistributed so that people can do something else. But this is a temporary problem, in this transitional phase. In any case, all the previous is a strictly political issue. | |
| 15 | **AGIMUS' framework results are expected to be the foundation of an open-source, international, robotics** | - |

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|---|---|---|
| | **software consortium. What kind of benefits would your company/organisation expect to participate in it?** | |
| | The impact would be that robots can be used in different areas, not only in production, to have an impact on other sectors (health, social, assistance to people, etc.). Being open source, there will automatically be benefits for everyone and it will be applied immediately (no patent time). | |
| 16 | **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?** | - |
| | 5G has a high bandwidth; if large dataset AI training is done through 5G, the system can be easily saturated. | |
| 17 | **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.** | EU ethics guidelines for trustworthy AI key requirements:<br>1. Human agency and oversight<br>2. Technical robustness and safety<br>3. Privacy and data governance<br>4. Transparency<br>5. Diversity, non-discrimination and fairness<br>6. Societal and environmental wellbeing<br>7. Accountability |
| | Transparency (4) is the most important thing, because you know if the AI is working with ethical principles or not, with totally ethical and neutral criteria and based on objective data.<br><br>Non-discrimination, that it is dedicated to the good of society and all this comes from transparency.<br><br>Privacy (3), like any other technology. | |

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|---|---|---|
| | | |
| 18 | **Would you consider any additional aspect of agile production & implementation of versatile autonomous robotics that we did not manage to address?** | Goal: to check the completeness of the questionnaire & make adjustments; to receive feedback on aspects not covered |
| | Finding the transition path is very important. First, we should think about what we wnt for the future and define it; as a consequence of this, we have to think on how to start implementing the technologies. | |