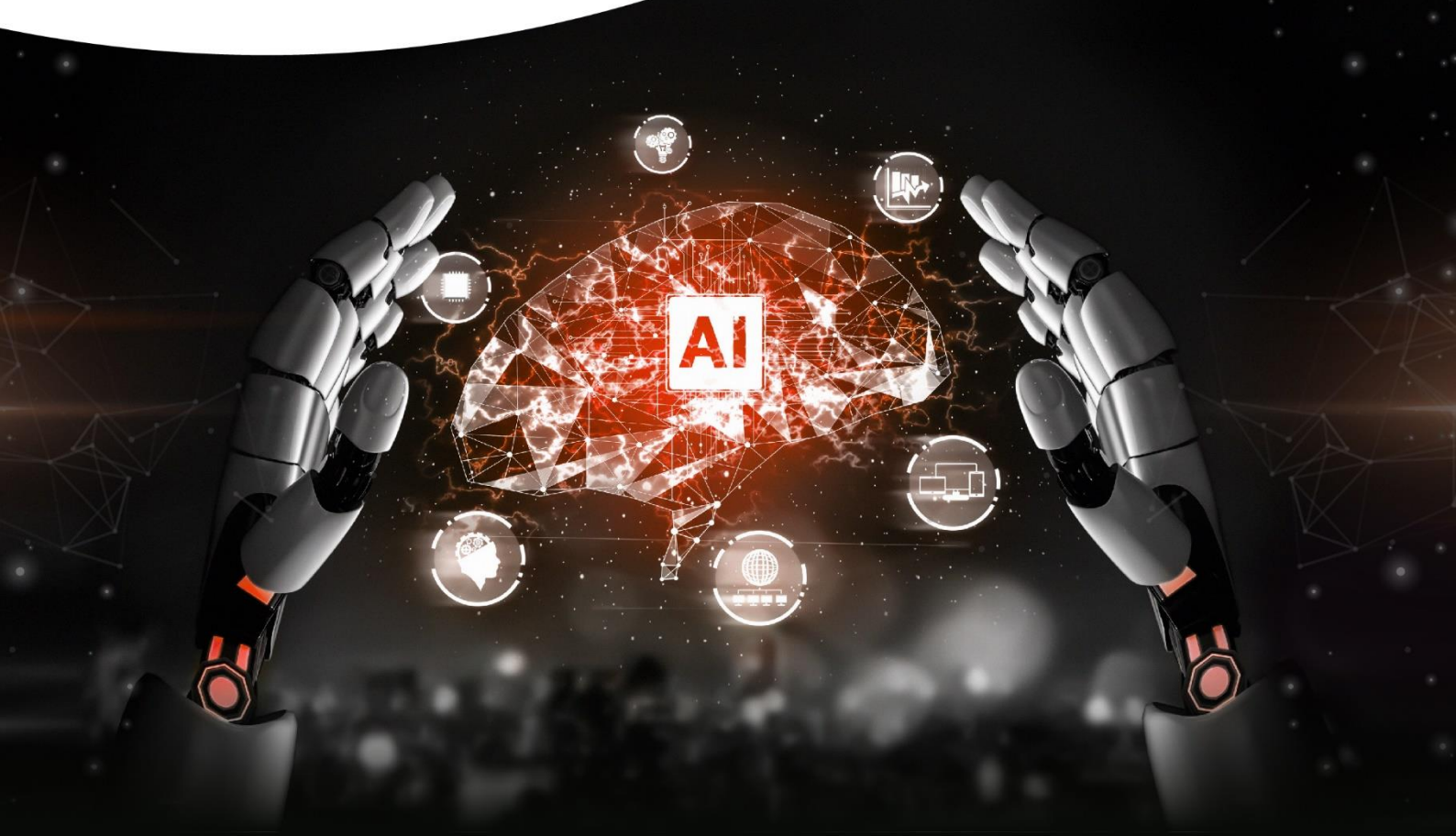
AGIMUS

INNOVATIVE ROBOTICS FOR AGILE PRODUCTION

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	*studies or vocational training, scientific expertise*
Organisation type	*Industry*		
Positioning in the organisation	Coordinator of the production		
Level of expertise in robotics	**INTERMEDIATE**		
Level of experience in production (agile or otherwise)	**HIGH**		
Country	Czech Republic		

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. Indicative definition: *"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."*
	Answer: Production, with fast flexible changes without complex processes, simple to understand	
2	**How do you envision versatile robotics could address the agile production line needs?**	Indicative definition: "*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.*"
	Answer: Operating the robot must be simple to operate and fast to setup for production, our workers are often people with basic education. The smarter the robot, the better. It must also ideally be easy to maintain and withstand the harsh effects of production.	
3	**Are you aware of any versatile robotics solutions for agile production?**	Goal: to find out about the competition e.g., advanced perception algorithms, Task-And-Motion

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	Are you aware of any available or forthcoming technological solutions for agile production?	Planner, Cloud systems and Internet of Things
	Answer: Robotics helps increase work efficiency. I see the biggest benefit in sterotypical repetitive work, which is difficult and uninteresting for human workers. I know about agile solutions for our company, but I can't disclose them without permission	
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?**	-
	Easy to use (SW) – For the operators with basic education (easy operate, fast setup) Easy maintenance – To have easy access to broken parts Durability – To withstand the harsh effects of production Robot speed – Effectiveness of production Robot precision – To prevent mistakes on products/damaging products	
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?**	-
	Many types of automatic machines are used in our factory, including robots. The robots are mostly used as a substitute for stacking products (example: ABB). Other production machines are mostly huge machines of several tens of meters in length, where there are rotating parts to process the product and conveyors for continuous transport	
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
	Demand for small series and complex orders. Our existing high-capacity machines can only handle a limited range of products, which often differ only slightly. The customer welcomes any form of product differentiation and personalisation and is willing to pay for it	
7	**How were technology changes in your production process seen by the employees? What allowed them to**	-

No	Interview's topics/questions	Notes for interviewers *(to activate/trigger the dialogue, or give some hints, explanations, or examples)*
	take place? What did perhaps decelerate/accelerate their progress or reduce/increase their acceptance?	
	Our employees welcome any technology that makes their lives easier. On the other hand, they don't welcome technology that "seems" to make their lives easier but actually adds extra work. Or the technology is too complex to understand.	
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
	In general, people are afraid of robots and thinking that they taking their jobs. But actually, robots replace their position and create a new position for the workers (robot operator). The robot improves the life of the workers by doing complex tasks for them. However, it only does this if the worker sets it up well. Also robots are more effective and faster but human presence is necessary to watch over the robot.	
9	**Which are the 5 most important challenges that agile production lines face in your opinion? Why?** **Does the use of versatile robotics create more/different challenges? Why?**	e.g., culture, access to properly skilled human capital, technology, regulations, policy support e.g., excessive deployment time, maintenance, costs, any other particularity
	Administration - often before a worker enters a job into the system, the machines produce it so quickly that the worker is held up by paperwork rather than production. Complexity - The more complex the products are, the greater the error rate is Controlling - Agile production is sometimes hard to control and causes error rates on products (someone missed something) Fatigue - In agile production, operators get tired faster and their performance decreases Safety - In agile production, the risk of injury is greater (because you are in a hurry)	
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

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		how to carry out repetitive tasks may be required
	As long as the AI makes their job easier. If, on the other hand, they don't find AI beneficial or too complex to operate and maintain, they will evaluate it negatively and, in the extreme case, refuse to use it	
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
	Safety of operators and protection against damage to company property	
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
	100% reliability in terms of work. Minimum error rate of work. Safety of operators.	
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

No	Interview's topics/questions	Notes for interviewers *(to activate/trigger the dialogue, or give some hints, explanations, or examples)*
	About cost effective, I'm not right person to ask. About AI. I dont have experience with complex neural AI yet, unless you count translatable AI like DeepL which is helping me to answer here properly.	
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?**	-
	As I mentioned before. Our experience with robotics so far has been that it has opened up new positions and employees have moved to them. The main benefit of automated machines is the efficiency of work.	
15	**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?**	-
	Prestige. It can potentially attract new customers that are looking for unique and fast solutions for their products.	
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?**	-
	I don't know yet and I'm not right person to answer this question	
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: 1. Human agency and oversight 2. Technical robustness and safety

No	Interview's topics/questions	Notes for interviewers *(to activate/trigger the dialogue, or give some hints, explanations, or examples)*
		3. Privacy and data governance 4. Transparency 5. Diversity, non-discrimination and fairness 6. Societal and environmental wellbeing 7. Accountability
	As long as it doesn't violate our local laws, we don't address it	
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
	Unfortunately, I'm not intimately familiar with our company's strategy regarding new technologies, but I expect there is an interest	