Value Of Joint EXperimentation in digital Technologies for manufacturing and construction

Open Call 2 Pilot
Guide for Applicants
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1. INTRODUCTION

VOJEXT Project is funded by the European Commission under the European Union’s Horizon 2020 Digitising and transforming European industry and services: digital innovation hubs and platforms programme and the call topic ICT-03.

The project was launched in July 2020 to provide a favourable business and technological framework to enable matchmaking and encourage producers and adopters (mainly SMEs including small crafters) of Cognitive autonomous systems for human-robot interaction, specially “cobots”, dynamizing science-driven industry approaches for the European industry. For this purpose, VOJEXT will design, develop, validate and demonstrate affordable, market-oriented, agile, multipurpose and easy-to-repurpose, autonomous, mobile and dexterous robotic systems as the main component of a smart, agile and scalable cognitive CPS (Cyber-physical system) for industry; under the vision of providing Value Of Joint EXperimentation (VOJEXT) in digital technologies to manufacturing and construction industry; while having DIHs as drivers of innovation based economic development in Europe.

VOJEXT will demonstrate its value by deploying the solution through a 42-months’ work plan scaling the project to at least 5 additional different markets; starting with 5 experimental pilots (and 9 SMEs) in the plastic textile, electronics, automotive, construction and creative architecture for urban regeneration, VOJEXT cover traditional and non-traditional areas for AI-robotics and cognitive ICT developments, aiming to extend experimental pilots and integrating SMEs through open calls. The open calls will foster scientific, and business driven innovation together Digital Innovation Hubs led by UPM- AIR4S (Spain) and other 3 DIHs – Fortiss (Germany), PIAP (Poland) and EMC2 (France). The project started in 2020 and will end in 2023.

The Open Calls will gather the most innovative SMEs, that will bring new challenges into projects’ pilots and propose alternative scenarios. Moreover, the project will carry out with 2 S+T+ARTS residencies, that will allow artists stimulate the creation of new product in different contexts and support creative craft experimental pilots in Italy. DIHs will create a new niched oriented offering based on VOJEXT technical areas and for crafting sector.

This document aims to describe the open call rules, process, and timeline, contact information and relevant technical details for the applicants prepare a quality proposal to submit to Open Call 2 Pilot.

1.1 Main Concept

VOJEXT concept comprises seven pillars, following a modular development approach that matches technical areas of interest for adopters and suppliers of cognitive and autonomous management, as well as a new niche-oriented offering of services for DIHs, which will be driven by manufacturing SMEs needs and driven by large enterprises complex needs. VOJEXT will build on the principles: Modular development, flexible integration, decentralisation, interoperability, collaboration, adaptability and product personalisation, and teaching by demonstration is the core that will enable the learning of new tasks and strategies.

VOJEXT concept will deploy up to 15 experimental pilots that provide challenges and opportunities for producers and adopters (mainly SMEs including small crafters) of cognitive autonomous systems for
human-robot interaction under a modular approach, while building and developing a favourable framework for the companies to develop capabilities, and in turn learn from this deployment to generate new niche specific supporting services for these modules or areas for the DIHs. This means, we have divided VOJEXT Cognitive control and autonomous management which comprises the Cyber-Physical System (CPS) encompassing sensors for logistics, coordination and management processes and supporting run time in the following technical modules/sub-modules (design time):

- **Advanced CPS high-level modules** with sub-modules for common semantic integrating the description language and Shared Knowledge Base (SKB), the semantic Planning, Execution and Management Knowledge Reasoning Engine (PEMKRE) and High-level Control Engine Module (HICEM) as an interface between high-level and low-level modules.

- **Cognitive robotic system low-level modules**: the cognitive robotic systems consist of a digital brain that represents an integrated ecosystem (suite of services) using existing middleware to control the movement of all parts of the robotic system or capture the surrounding information of the system. This includes the Physical Interface Module (PIM), the Interactive and Sensory Interface Module (ISIM), the Low-level Control Engine Module (LOCEM), the Perceptual Engine Module (PEM), the Safety Ergonomic Module (SEM), the Social Interaction Manager (SIM) and links with the High-level Control Engine Module (HICEM).

- **Reduction of waste, energy and resource** consumption and efficient logistic processes.

- **Physical approach of the VOJEXT’s robotic system (hardware)**: VOJEXT’s robotic system is based on the combination of different current commercial products. It consists of five basic components: processing and sensing sub-systems, hand/gripper, robotic arm and mobile platform, assembled to achieve the stated objectives.

In turn for the DIHs this four big modules and their corresponding sub-modules become “areas” of research and opportunities for industry providers of AI and robotic technologies, where the industry can provide challenges (as it has been done in the first 5 VOJEXT experimental pilots) and the DIH can develop new and niche competitive services to strengthen the current DIH offering.

Figure 1 shows the view how VOJEXT integrates technically the above modules as a favourable business and technological framework to support agile manufacturing in the 4.0 manufacturing space and technological developments, which will be matched by DIH as business-oriented services.
1.2 VOJEXT’s validation & scalability approaches

**Figure 2: Vojext Scalability Approaches Summary**

**VOJEXT** demonstrates its value through 5 different experimental pilots, which will be evaluated in 5 different sectors (plastic textile, electronics, automotive, construction and creative architecture for urban regeneration); covering the construction and manufacturing sectors at large in 4 different locations (Spain, Hungary, Italy and Turkey).

**Use Cases**

- Societal understandings of robotics: (ethics, collaboration, environment, etc)
- Collaborative working: Human environments + trust toward robotic collaboration
- Acceptance & Learning: walking together!

**Artists**

VOJEXT brings new scenarios by fostering scientific and business driven innovation under the umbrella of the Digital Innovation Hubs in Spain, Germany, Poland and France that specialize in robotics, artificial intelligence, automation and manufacturing; which will be linked to other seven DIHs in Hungary, Romania, Lithuania, Italy and United Kingdom through the External Experts Advisory Board.

**DIHs**

€850K for cascade funding across a total of up to 5-8 projects upgrading VOJEXT demonstrators + 5-8 new pilot demonstrators, all of which selected through an open call procedure.

**Open Calls**

€60K for S+T+ARTS residencies
VOJEXT’s Use-Cases in a Nutshell:

**Figure 3: Use Cases Summary**

### 5 USE CASES / 5 INDUSTRY DOMAINS / 4 COUNTRIES

| Viscoelastic Polyurethane Pillow Handling | Electronics and fragile components | Automotive Smart Manufacturing | Crafts, culture and creativity | Building Construction (Wall Finishes) |
| PLASTICS (HUNGARY) | ELECTRONICS (ITALY) | AUTOMOTIVE (TURKEY) | CRAFTS (ITALY) | CONSTRUCTION (SPAIN) |

**Use Case Technical Challenges:**

**Table 1: Use-Case Technical Challenges**

<table>
<thead>
<tr>
<th>Use cases</th>
<th>CPS challenges</th>
<th>Manipulation challenges</th>
<th>Visualisation Challenges</th>
<th>Human-Robot interaction</th>
<th>Safety and ergonomics</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC1</td>
<td>Efficient logistics</td>
<td>Flexible objects</td>
<td>Complex reconstruction</td>
<td>Co-working (punching)</td>
<td>Possible physical contact</td>
</tr>
<tr>
<td></td>
<td>Start/stop in continuous process</td>
<td>Different size/weight</td>
<td>Complex environment</td>
<td>Big objects, dangerous tools</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Indoor navigation</td>
<td>Repeated movements</td>
<td></td>
</tr>
<tr>
<td>UC2</td>
<td>Reduction of waste</td>
<td>Position and orientation</td>
<td>Complex objects</td>
<td>Co-working (movements)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discrete production in continuous process</td>
<td>Fragile objects</td>
<td>Complex recognition (very similar objects)</td>
<td>Free movement collaboration</td>
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<tr>
<td></td>
<td></td>
<td>Slim objects</td>
<td></td>
<td>Tiny and sharp objects</td>
<td></td>
</tr>
<tr>
<td>UC3</td>
<td>Reduction of waste, planning and efficiency</td>
<td>Deformable and different temperature manipulation</td>
<td>Complex and physical recognition and reconstruction</td>
<td>Learning from physical object parameters</td>
<td>Safety, security, high temperature in manipulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Repeated movements</td>
<td></td>
</tr>
<tr>
<td>UC4</td>
<td>Time planning</td>
<td>Position, orientation</td>
<td>Large surfaces</td>
<td>Object exchange</td>
<td>Possible physical contact</td>
</tr>
<tr>
<td></td>
<td>Resource consumption</td>
<td>Different heights</td>
<td>Complex environment</td>
<td></td>
<td>Long cables</td>
</tr>
<tr>
<td></td>
<td>Re-allocation</td>
<td>Triggers</td>
<td>Navigation (rough floors)</td>
<td>Co-working scene</td>
<td>Use of sprayers</td>
</tr>
<tr>
<td></td>
<td>Reconfiguration</td>
<td></td>
<td>Lighting</td>
<td></td>
<td>Repeated movements</td>
</tr>
<tr>
<td>UC5</td>
<td>None; to be experimental and see CPS potential</td>
<td>Objects Different size/weight</td>
<td>Complex environment</td>
<td>Co-working (picking)</td>
<td>Possible physical contact</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Indoor navigation</td>
<td></td>
<td>Repeated movements</td>
</tr>
</tbody>
</table>
DIH (Digital Innovation Hub):

DIHs provide access to technical expertise and experimentation, so that companies can “test before invest”. It helps companies become more competitive regarding their business/production processes, products or services using digital technologies.

DIHs also provide innovation services, such as financing advice, training and skills development that are needed for a successful digital transformation. In addition, DIHs are supported by I4MS (ICT Innovation for Manufacturing SMEs). I4MS is a European initiative supporting manufacturing SMEs and mid-caps in the widespread use of information and communication technologies (ICT) in their business operations. Under this initiative, SMEs can apply for technological and financial support to conduct experiments allowing them to test digital innovations in their business via open calls.

Artists: Art-Driven Innovation:

For this purpose, VOJEXT will engage artistic research and innovation methodologies by hosting two S+T+ARTS Residencies that will be selected through open calls in S+T+ARTS format and will invite artists, as art-science partners, to collaborate with VOJEXT technology, robotic, academic and industrial partners in the following fields:

- **Societal understandings of robotics:** attributes for a digitized working environments (ethics, collaboration, environment, etc.)
- **Collaborative working Human environments**, with human trust toward robotic collaboration as a key factor VOJEXT innovation to succeed: design factors, robotic interfaces, usage context on human-robot trust attributes.
- **Acceptance & Learning:** walking together!

1.3 Open Call 2 Pilot

For call 2, the consortium deems that at least technical challenges addressing the following areas:

<table>
<thead>
<tr>
<th>Table 2: Challenges Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Challenges</strong></td>
</tr>
<tr>
<td>Challenge 1 - Warehouse management</td>
</tr>
<tr>
<td>Challenge 2 - Robots for logistics supporting and demonstrating capabilities in real operational environments</td>
</tr>
<tr>
<td>Challenge 3 - Graphical overlay design for core UI</td>
</tr>
<tr>
<td>Challenge 4 - Clean rooms and clean environments</td>
</tr>
<tr>
<td>Challenge 5 - Metrology and Reconstruction</td>
</tr>
<tr>
<td>Challenge 6 - Machine Learning-based Material Characterization</td>
</tr>
</tbody>
</table>
The call is open for submission from 5th October 2022 (12:00 PM CET) to 7th December 2022 (5:00 PM CET), and its indicative budget is €460,000.

Applicants will have to select among one of x challenges/experiments to build their proposal. These topics are further detailed in the following.

1.3.1 Challenge 1 - Warehouse management

<table>
<thead>
<tr>
<th>Domains</th>
<th>Warehouse, logistics, storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>The objective of this challenge will be to test the capabilities of the VOJEXT-ecosystem to be adapted to a totally new domain such as the logistics. The platform should be equipped with the needed technology to detect and mapping human gestures within a provided catalogue of gestures, and to overcome the major technical obstacles such as getting an item off the shelf and place it into a box. Following this process, the robot can optimize the production by saving time and energy, freeing workers to attend other tasks. The efficiency will be measured using KPIs such as the average time for a request to be delivered. For this purpose, the scenario will be a cooperative environment located inside a warehouse where a human operator, using a gesture, requests to a robot, to fetch an item, located somewhere inside the warehouse, needed for continuing the manufacturing of a product. With the aim of facilitating the challenge, the item will be simple squared boxes of different sizes, all easily to manage by the robot. The position of the item inside the warehouse, will be mapped (eg: (item 1 located in shelve at position X1,Y1, item 2 located in shelve at position X2,Y2, ...))</td>
</tr>
<tr>
<td>Context/environment</td>
<td>A warehouse is a key site in production facilities for the preparation of the final product; that involves some complex tasks such as the retrieval of stored items. The correct management of the production flow implies an increase of productivity in the manufacturing line. The cooperation of robots and humans will optimize this process. Robots can make some work faster and more regular than human operations, but how fast a robot can work is related to the type of task. In some cases, human workers are very fast due to their manual skills while the robot must be told exactly what to do. As an example, human workers in a non-automated warehouse spend 70% of their time walking around to fetch items. Therefore, this might be a suitable task to develop robot replacements for. Robots are already used for item picking by companies such as Amazon. The detailed set of steps envisioned for this challenge are: 1. Detection by the robot of key gesture made by the operator.</td>
</tr>
</tbody>
</table>
2. Using the catalogue of gestures provided by the VOJEXT ecosystem, match the detected gesture with the search gesture.
3. The operator indicates the item to be retrieved by means of a proposed interface (tablet, computer vision, other...)
4. The robot knows the target X,Y position inside the warehouse and navigates itself. The navigation in real time including avoiding of obstacles must be already provided by the mobile robotic platform defined in challenge 2.
5. Once in front of the right shelf, detect the correct item by means of any technology (RFID, tags, other except based on computer vision which are already implemented in VOJEXT).
6. Fetch the item off the shelf and place it into a box located on the robot
7. The robot navigates back to the operator.

**Specifications/integration**

The solution must measure how easily the VOJEXT ecosystem could be adapted to a new environment by overcoming the existing challenges. It should propose a combination of mobile platform, technology for object detection (RDFI sensor/codebar reader, computer vision, other), new robotic arm/gripper for collecting the item and end-effectors that is programmed for identifying gestures. The robotic hand/gripper and arm will be integrated into the mobile robotic platform defined in challenge 2.

Summarizing, 3 Main challenges must be solved within this project:
1. Detecting the search/init gesture made by a human operator and mapping it into a catalogue of gestures provided by the VOJEXT ecosystem.
2. Test new interfaces of communication with the operator (for providing information about the item)
3. Detecting the correct item placed on the selves by using a proposed technology (e.g.: RDFI/barcode technology, other than computer vision, etc).
4. Fetch the item off the shelf and place it into a box located on the robot.

**Expected Results**

A demonstration of the system must be provided, where a robot placed in a warehouse, with a loaded map, is requested using a gesture from a human operator, to fetch items (only a single item at the same time) located in different positions of the facilities.

Different iterations can be provided where the first demonstrator does not require a full system, but since the beginning the project, the applicants must consider an integration plan with the proposed robotic platform defined in challenge 2.

At the end of the project, a final demonstration will be performed in an ad-hoc environment that includes several selves with several items.

For the final evaluation of the solution, it is very important to define a number of KPI’s of the full system. Here, we provide a suggested list of KPIs:
1. Success rate understanding the search gesture from the human operator.
2. Success rate detecting the objects with the integrated software.
3. Time needed to retrieve the item inside the warehouse.
4. Success rate identifying the correct item on the shelves.
5. Execution time of the overall process (very important KPI, due that we want to proof that we optimize the process).

How will this challenge contribute to VOJEXT?

Proof that the existing VOJEXT development could be easily adapted to a different market domain such as the logistics is. These challenges are relevant for the project due that it may open a new business niche by integrating the detection of new objects and new manipulators into the platform. The use of the existing catalogue of gestures will provide us a more robust texting and feedback about the simple to use of them.

Indicative Budget

80K Euros divided:
- 40 K development
- 20 K equipment
- 10 K final demo
- 10K integration/test with Challenge 2

Indicative Duration

6 months + 2 months for testing the solution with the team that will address Challenge 2

1.3.2 Challenge 2 – Robots for logistics supporting and demonstrating capabilities in real operational environments

Table 4: Challenge 2

<table>
<thead>
<tr>
<th>Domains</th>
<th>Robotics. Use cases/demonstration environment: in plastic, wood, metal/robotic or construction.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>To integrate software developed in Challenge 1 in an existing mobile robotic platform that can experiment with the integration of software developed by third parties which have integrated VOJEXT modules, while providing a demonstration in different robotic and operational environment than those provided by VOJEXT partners. A demonstration of the integration in a real operational environment/use case (from the area of plastic, wood, metal or construction); also aims at enhancing and demonstrate value through the logistic processes in manufacturing using robotics and integrated technologies, such as the usage of codebars and sensors/cameras to support new ways to manage product stocks in factory logistics.</td>
</tr>
<tr>
<td>Context/environment</td>
<td>Robots are increasingly used in warehouses and storage facilities to organize and transport products, as the integration of robots in logistics automate the process of storing and moving goods. Human–robot collaboration is a key for the development of factories of the future. Robotics can allow for workforce adaptability</td>
</tr>
</tbody>
</table>
and support safety. Safety for workers shall increase as robots can support over dangerous actions such as getting items from high racks or storage spaces. Safety is one of the most critical aspects in the collaborative human–robot paradigm. Also, robotics in this area can reduce human errors and increase delivery speed.

The solution shall demonstrate scalability of VOJEXT related developments in manufacturing domains related to VOJEXT (plastic, wood, metal/robot or construction); showing the process of adaptation based in the use case/real operational requirements and overcoming the existing challenges (functional and technical). In addition, provide experimental results to recommend KPIs or measurements that can be integrated in the VOJEXT KPI library, such as KPIs linked to safety, correctness of loading (e.g. based on historical loading), waste generated due to wrong loading, performance, impact on production or customer satisfaction.

The proposed robotic platform must be conceived for the development of industrial applications (e.g., logistics, warehouses & other intra-logistics applications, industrial mobile manipulation, pick & transport & place), including navigation avoiding obstacles. With the aim of facilitating the integration with the VOJEXT development, the robotic platform must be an open architecture ROS based system.

<table>
<thead>
<tr>
<th>Specifications/integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>The software developed in Challenge 1 shall be integrated in the existing mobile robotic platform brought by the manufacturer or its coupled robotic partner. It should integrate in mobile platform, the technology developed in Challenge 1 for object detection (RFID sensor/codebar reader, computer vision, other) as well as the end-effectors programmed for identifying gestures. The arm/gripper/loader shall be adapted to the new use case requirements to collect the needed items in the use case demonstrator. The proposed robot shall integrate also required sensors/cameras to record and/or provide a sequence of loading scenarios that provide images/videos that could be used for analysis of product stock (e.g. images that could be compared to know if products are missing). The experiment also aims at providing new ways of supporting stock management.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile robot platform that integrates software from Challenge 1 for managing logistics process with demonstration in a real manufacturing operational environment (providing a use case). The demonstration environment could be the logistic or warehouse of the robot manufacturer (if a manufacturer) or a manufacturing company that comes to this call and provides real logistic operational environment. For the final evaluation of the solution, a set of KPIs that measure integration and developments shall be defined. Here, we provide a suggested list of KPIs:</td>
</tr>
<tr>
<td>1. Success rate of software integration and link to VOJEXT platform.</td>
</tr>
<tr>
<td>2. Success rate placing the item retrieved in challenge 1 into the box on the robot.</td>
</tr>
</tbody>
</table>
3. Time needed to retrieve the item inside the warehouse, or success to place the box in the robot
4. Safety performance or measurements improvements.
5. Processable set of images to support stock management

**How will this challenge contribute to VOJEXT?**

The robotic technology and operational environment shall support how experimental areas can be added to VOJEXT developments, thus show scalability of the project and its complementary developments (those produced by an organisation participation as an open caller). This experiment is complementary and expands the domains and challenges already assessed by the VOJEXT consortium for demonstrating the benefits of human-robot collaboration in factories of the future.

The challenge will also evaluate how seamless is install the VOJEXT solution on another robotic mobile platform.

**Indicative Budget**

80K Euros divided:
- Robotic company: 30-40 K integration and developments
- 20-30 K equipment
- 20-25 K real operational environment demonstrator, that can be paid to a manufacturing SME providing the use case of the Robotic company if provides its own warehouse environment.

**Indicative Duration**

3 months in total (1 month (starting in M6 of challenge 1) + 1 month for testing + 1 month if needed for demonstration)

### 1.3.3 Challenge 3 – Graphical overlay design for core UI

**Table 5: Challenge 3**

<table>
<thead>
<tr>
<th>Domains</th>
<th>No specific VOJEXT domain.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>Design a graphical layer for VOJEXT generic user interface (UI) that meets the usability, functional and aesthetic needs of the VOJEXT system. This includes creation of several concept solutions, regular consultations with VOJEXT team working on core UI and prototyping the selected graphical user interface (GUI) concept with respect to requested user experience and ergonomics. The graphical overlay design covers the GUI architecture and all visual components of VOJEXT system GUI (buttons, lists, menus etc.) delivered as graphical assets. Applicant SME should incorporate an artist(s) into GUI development process in order to design non-invasive and intuitive interfaces for social interaction with VOJEXT system.</td>
</tr>
</tbody>
</table>
| Context/ environment | The core UI for VOJEXT system is planned to be developed by project partners. This UI will feature basic functionalities and will allow interaction with the system. The challenge applicant task is to improve user experience by adding custom-designed graphical layer (GUI) that will be software-generated by UI and make the user-
system interaction seamless and intuitive. The participation of representatives of the artistic community is encouraged, since such contribution to the GUI creation process should increase the aesthetic value of the created solution, providing appropriate for VOJEXT system end-user experience (UX).

<table>
<thead>
<tr>
<th>Specifications/integration</th>
<th>General graphic design requirements:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Material Design compatibility (<a href="https://material.io">https://material.io</a>)</td>
</tr>
<tr>
<td></td>
<td>• Graphic representation in .png format (file format with transparency) along with source files in .psd format.</td>
</tr>
<tr>
<td></td>
<td>• Two display themes: light/dark mode</td>
</tr>
<tr>
<td></td>
<td>• Graphic representation of each subpage with description of colours used (HEX or RGB colour codes)</td>
</tr>
<tr>
<td></td>
<td>• Separate representation of each UI element (buttons, switches, check boxes, text boxes, date/time selection etc.) with description of colours used (HEX or RGB colour codes)</td>
</tr>
<tr>
<td></td>
<td>• Graphic representation for various resolutions (the layout of main page and subpages will be resolution-dependent)</td>
</tr>
<tr>
<td></td>
<td>• Icons in separate files.</td>
</tr>
<tr>
<td></td>
<td>• Each active interface element (e.g. button icon or scroll bar) for the preview should be prepared in at least 3 sizes, agreed upon during the design work.</td>
</tr>
<tr>
<td></td>
<td>• Three colour themes, including default based on VOJEXT page colours.</td>
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<tr>
<td></td>
<td>• The GUI design must include the use of touchscreen devices, which means appropriately scaled interactive GUI elements.</td>
</tr>
<tr>
<td></td>
<td>• Expected resolution – FHD (1920x1080) and devices with display density of 200 PPI (pixel per inch) Multiple language support is required (English, Hungarian, Italian, Turkish, Spanish).</td>
</tr>
<tr>
<td></td>
<td>• Availability of personalization/customization options for quantity of elements in menu layouts or buttons in individual screens.</td>
</tr>
</tbody>
</table>

Detailed specification of the requirements will be defined and fixed after end-users’ requirements gathering process.

The applicant will be provided with insight to the VOJEXT core UI architecture and will consult project partners on regular basis to get an understanding of the UI architecture and functionalities. While the applicants work will mostly pertain to topmost layer of UI, their feedback on core interface design will also be taken into consideration.

| Expected Results | • Concept designs for final VOJEXT GUI – several visual representations of proposed designs, among which the one will be selected as go-to design |
- GUI architecture design – project of GUI pages and subpages structure with all interactive and background components
- The graphical overlay description for core VOJEXT GUI with source files – layout design and all components of GUI such as buttons, menus, checkboxes, etc. which contribute to UX tailored for VOJEXT end-user. Graphical overlay description should allow software generation of GUI elements.

The partial results and the process progress will be recurrently evaluated and eventually presented for the final evaluation.

How will this challenge contribute to VOJEXT?

Once the core technical work on UI is defined by partners, the OC2 challenge will address development of GUI for command and management in terms of identified functionalities, as well as aesthetic and ergonomic design supported by S+T+ARTS. The work within this challenge will apply to all scenarios and domains covered by VOJEXT. While not critical for technical operation of the system, it will significantly improve the final experience and user convenience.

Indicative Budget

Up to 60K Euros divided as follows:
- 50K in personnel claims
- 5K in equipment related to developments
- 5K meetings claims

Indicative Duration

6 months

1.3.4 Challenge 4 – Clean rooms and clean environments

<table>
<thead>
<tr>
<th>Domains</th>
<th>Clean rooms (Laboratories, Pharma, Medical, specific industries, ...)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>The objective would be to involve a system integrator that has access to and deploys/offers technologies and use cases in pharma, medical or other specific industrial domain where clean rooms are used. This environment can benefit of VOJEXT solutions related to robotics mobile manipulation, minimizing the interaction of people and repetitive access to controlled facilities. The use case would consist in adapting the existing technologies to overcome challenges in this domain. Teleoperation of the mobile manipulator could be envisioned in order to keep humans outside the rooms.</td>
</tr>
</tbody>
</table>

Table 6: Challenge 4
Specific adaptations to the robotic vehicle towards the clean room requirements could be identified, developed and adapted to the existing VOJEXT robots.

**Context/ environment**

A cleanroom or clean room is an engineered space, which maintains a very low concentration of airborne particulates. It is well isolated, well-controlled from contamination, and actively cleansed. Such rooms are commonly needed for scientific research, and in industrial production for all nanoscale processes, such as semiconductor manufacturing. A cleanroom is designed to keep everything from dust to airborne organisms, or vapourised particles, away from it, and so from whatever material is being handled inside it.

The other way around, a cleanroom can also help keep materials escaping from it. This is often the primary aim in hazardous biology and nuclear work, in pharmaceutics and in virology. Cleanrooms typically come with a cleanliness level quantified by the number of particles per cubic meter at a predetermined molecule measure. The ambient outdoor air in a typical urban area contains 35,000,000 particles for each cubic meter in the size range 0.5 μm and bigger, equivalent to an ISO 9 certified cleanroom. By comparison an ISO 14644-1 level 1 certified cleanroom permits no particles in that size range, and just 12 particles for each cubic meter of 0.3 μm and smaller. Semiconductor facilities often get by with level 7, while level 1 facilities are exceedingly rare.

The kind of work that is conducted in such environments can also benefit from the adoption of service robotics in a number of different operations. The fewer access to the site and personnel working in the area, the more controlled the environment is. For that reason, the autonomous mobile robot with the needed adaptation could contribute by automating some manipulation activities or even provide means of remote actuation/teleoperation to the expert workers without exposing themselves.

**Specifications/ integration**

The VOJEXT robotic platform is an autonomous and independent robotic system that can perform complex tasks effectively, especially regarding the grasping and manipulation of objects in collaborative environments with human partners. The set of tools developed in VOJEXT comprehend different software elements for control at different levels, perception, cognition or human interaction. When it comes to the actual hardware, we should be considering different off-the-shelf devices such as cameras, computers and IoT devices or communication antennas, together with the multi-purpose robotic mobile manipulator based on Robotnik’s RB-KAIROS platform.

Finding different fixed elements of the above list that might be compliant with the standards should be part of the work. However, the bulk of it should consider the innovative robotic mobile manipulator that already has most of the devices embedded.
RB-KAIROS+ is a mobile manipulator designed for the plug&play integration of Universal Robots e-Series arms. Its software and hardware are fully prepared to mount the arm OEM DC e-series and thus turn the robotic arm into a mobile manipulator. This allows unlimited expansion of the cobot workspace that can operate on large parts or perform pick&place operations in large areas. RB-KAIROS+ has a robust steel design and can carry up to 250 Kg. The mobile platform has omnidirectional kinematics based on 4 high-power drive wheels. RB-KAIROS+ can navigate autonomously and can be configured with a wide range of sensors and components found within the UR+ ecosystem.

### Expected Results

The main outcomes from the challenge would be:

- A detailed study on the requirements, challenges, technical constraints, existing solutions for robotic systems in the field and proposed adaptations in order to bring the VOJEXT Collaborative robotic system to such working environment, with specific focus to the existing VOJEXT’s mobile robots (Robotnik’s RB-KAIROS) adoption. The document should present a risk assessment related to the adoption of robotic systems to the controlled environment, including risk factors like 1) entry, exit and movement procedures; 2) storage factors while in the cleanroom; 3) contamination factors during use; 4) generation of electrostatic charges. Special attention should be put on how the robot operation affects critical indicators and support parameters and factors including heating, ventilation and air conditioning functions, pressure, temperature, humidity, air change and filtering and then surfaces and moving parts that shed or generate any contamination.
- Sub-systems prototypes adapted to the VOJEXT technology (with focus to the mobile manipulator) made in order to comply with the standards and covering different aspects:
  - Encapsulation of exposed cameras and other sensors when needed
  - Refrigeration subsystem for robot electrical cabinet compliant with space and power constraints.
  - Surfaces and moving parts adaptations in order to reduce airborne particle generated from the robot operation, with special attention to the wheel’s material.
  - Decontamination and/or Disinfection procedure specifically designed for the robot system operation

All sub-system prototypes will be developed with the collaboration/supervision of VOJEXT partners. This development phase will include a feasibility study taking into account efficiency and cost limitations.

Access to the robots will be granted by visiting the manufacturer’s (Robotnik) facilities as per an agreed calendar

- An Implementation Plan where a specific use-case is envisioned inside a clean room involving the operation of the VOJEXT collaborative robotic system. Steps needed in order to comply with the standards should be described. A demonstration in such environment or a simulated one will be considered.

<table>
<thead>
<tr>
<th>How will this challenge contribute to VOJEXT?</th>
<th>Combining technological developments (related to specific domain requirements) with the actual opportunity of accessing and testing a new use case and market niche.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative Budget</td>
<td>Up to 80K Euro divided as follows:</td>
</tr>
<tr>
<td></td>
<td>- 50K in personnel claims</td>
</tr>
<tr>
<td></td>
<td>- 20K in equipment claims, related to prototype developments</td>
</tr>
<tr>
<td></td>
<td>- 10K in demo preparation and meeting claims.</td>
</tr>
<tr>
<td>Indicative Duration</td>
<td>- 7 months (4 months + 3 months for testing/demonstration)</td>
</tr>
</tbody>
</table>
### 1.3.5 Challenge 5 – Metrology and Reconstruction

<table>
<thead>
<tr>
<th>Domains</th>
<th>Metrology, reconstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td>To adapt new technologies in the metrology domain that can have a good synergy with mobile manipulation and collaborative robotics in order to substitute manual repetitive labour in favour of an autonomous inspections.</td>
</tr>
<tr>
<td></td>
<td>Different lidars and reconstruction devices used in order to find defects and check tolerances can be mounted on top of VOJEXTs mobile robots in order to fulfil an inspection of materials (big ones or in large number) in a wide range of domains.</td>
</tr>
<tr>
<td><strong>Context/ environment</strong></td>
<td>Industrial metrology is concerned with the application of measurement to manufacturing and other processes and their use in society, ensuring the suitability of measurement instruments, their calibration and quality control. In the last 20 years the technological advancements within Industrial metrology have been enormous.</td>
</tr>
<tr>
<td></td>
<td>From some time now, the adoption of robotics technology into the industrial and manufacturing fields are well known.</td>
</tr>
<tr>
<td></td>
<td>Robots are extensively used in operations such as parts handling, assembly, inspection or welding and their major robot performance indicators are repeatability and accuracy, followed by uptime, load capacity, velocity, and size of robot.</td>
</tr>
<tr>
<td></td>
<td>Metrology processes can also benefit from the automation by using robots, with the same well-known and stable performance. When it comes to repetitive processes that also have spatial information as a source, robotic devices can outperform humans in different ways. This is especially true for innovative 3D measurements using cameras and lidars.</td>
</tr>
<tr>
<td></td>
<td>Different devices for metrology applications using lidars and cameras are already in the market. The combination of those with robotic arms is a way of achieving benefits of different technologies. Then, major constraints of robotic arms are their limited range when in a fixed position and their inability to share working spaces with humans due to its dangerous nature of movements. Such robots will never have the possibility of performing metrology processes to big parts outside the cages or dedicated space for them to work.</td>
</tr>
</tbody>
</table>
|               | The proposal is to use the VOJEXT technologies applied to the mobile collaborative manipulator in combination with applicant’s
| Specifications/integration | The VOJEXT robotic platform is an autonomous and independent robotic system that can perform complex tasks effectively, especially regarding the grasping and manipulation of objects in collaborative environments with human partners. The set of tools developed in VOJEXT comprehend different software elements for control at different levels, perception, cognition or human interaction.

Software components aside, the platform is based in the multi-purpose robotic mobile manipulator RB-KAIROS+ from Robotnik. RB-KAIROS+ is a mobile manipulator designed for the plug&play integration of Universal Robots e-Series arms. Its software and hardware are fully prepared to mount the arm OEM DC e-series and thus turn the robotic arm into a mobile manipulator. This allows unlimited expansion of the cobot workspace that can operate on large parts or perform pick&place operations in large areas.

RB-KAIROS+ has a robust steel design and can carry up to 250 Kg. The mobile platform has omnidirectional kinematics based on 4 high-power drive wheels.

RB-KAIROS+ can navigate autonomously and can be configured with a wide range of sensors and components found within the UR+ ecosystem. |
This challenge is exploring the synergies of existing metrology applications using lidars and cameras, which could be mounted on top of the multi-purpose mobile manipulator, in the same way as many other end-effector used for other applications.

<table>
<thead>
<tr>
<th>Expected Results</th>
<th>The main outcomes expected are:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• A detailed report considering the working cycle of the full application, with insights on the new technology for 3D reconstruction and metrology. All the adaptations for the joint work, together with the processes, software or interfaces should be described together with an implementation plan. Further improvements will be described as well, with attention to joint exploitation activities.</td>
</tr>
<tr>
<td></td>
<td>• A working subsystem where the Lidar/camara/reconstruction or metrology technology is performing the expected activities while mounted on top of VOJEXT mobile manipulator</td>
</tr>
<tr>
<td></td>
<td>• The interfaces and basic GUI’s in order to perform the different processes combining robot movement and data gathering</td>
</tr>
<tr>
<td></td>
<td>• A demonstration of the process in a relevant environment</td>
</tr>
</tbody>
</table>

All sub-system prototypes will be developed with the collaboration/supervision of VOJEXT partners. This development phase will include a feasibility study taking into account efficiency and cost limitations.

Access to the robot will be granted by visiting the manufacturer’s (Robotnik) facilities as per an agreed calendar.

<table>
<thead>
<tr>
<th>How will this challenge contribute to VOJEXT?</th>
<th>These technologies represent a complementary area to those already assessed in the VOJEXT consortium, that can also be useful across the different use cases.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicative Budget</td>
<td>Up to 80K Euro divided as follows:</td>
</tr>
<tr>
<td></td>
<td>• 40K in personnel claims</td>
</tr>
<tr>
<td></td>
<td>• 30K in equipment claims, related to prototype developments</td>
</tr>
<tr>
<td></td>
<td>• 10K in demo preparation and meeting claims.</td>
</tr>
<tr>
<td>Indicative Duration</td>
<td>6 months</td>
</tr>
</tbody>
</table>
1.3.6 Challenge 6 – Machine Learning-based Material Characterization

Table 8: Challenge 6

<table>
<thead>
<tr>
<th>Domains</th>
<th>Material, manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>The objective of this open call is to train the manufacturing and process real data (ex. Real time temperature, pressure, viscosity, etc) can be varied based on the process) by using machine learning methods (ex. Artificial Neural Networks) to be integrated into CAD (design) and CAE (mechanical simulation) models. In addition to that, after implementing the software it is targeted to enhance the accuracy of the prediction of materials and components mechanical behavior. The purposes can be listed as below:</td>
</tr>
<tr>
<td></td>
<td>-... extract helpful information from the uncorrelated data set by understanding the data and finding the patterns inside them, which are not possible by humans.</td>
</tr>
<tr>
<td></td>
<td>- ... determine the data related to production and model parameters that affect the part quality, mechanical performance, production quality.</td>
</tr>
<tr>
<td></td>
<td>- ...the ambiguities and assumptions involved in the material modelling and characterization using conventional methods are avoided; instead, a data-driven method based on machine learning is used for material modelling.</td>
</tr>
<tr>
<td></td>
<td>Intercompany collaboration in the field of component engineering is not state-of-the-art due to strong competition. This complex supply chain and component model integration in NCAP or other new testing methodologies require for higher safety level new approaches.</td>
</tr>
<tr>
<td></td>
<td>This way, the margin of error in the simulation models decreases by joint effort. The ANN is supposed to decrease the margin of error in the FEM simulation models in the value chain and increase the accuracy of FEM simulations. Potential data source are the data taken from various manufacturing processes, tests, and advanced cameras. It was shown in previous research that implementation of an ANN in data characterization had been the efficient way in another context.</td>
</tr>
<tr>
<td>Context/ environment</td>
<td>A data-driven computational model framework is established such that the use of the material constitutive model is wholly ignored. By doing so, the complexity and uncertainty in constitutive models are avoided. The data repository is used as the machine learning algorithms' input data to establish this framework.</td>
</tr>
</tbody>
</table>
For machine learning models to understand how to perform various actions, training datasets are first fed into the machine learning algorithm, followed by validation datasets (or testing datasets) to ensure that the model is interpreting this data accurately. The more data you provide to the system, the faster that model can learn and improve. It is possible to program a machine learning algorithm like ANN & ML from scratch, however for its user-friendly implementation; various machine learning libraries are available in few programming languages.

<table>
<thead>
<tr>
<th>Specifications/integration</th>
<th>Mentioned on support document as material datasheet.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expected Results</strong></td>
<td>Lightweight decrease: up to % 10</td>
</tr>
<tr>
<td></td>
<td>Damage detection: at least 3 per part</td>
</tr>
<tr>
<td></td>
<td>Save of raw material: up to % 12</td>
</tr>
</tbody>
</table>

**How will this challenge contribute to VOJEXT?**

The Use Case 3 – Automotive Use Case – aims to monitor the production process (plastic injection) and the gripping & transportation processes dynamically. So real-time tracking of data collection through manufacturing process will level up the outputs of VOJEXT Use Case 3.

Additionally, using Artificial Neural Network (ANN) or one of other machine learning methods to train the data collected and to implement real-field material data into virtual FE model. This challenge is currently the most value-added topic within project scope, since there is a solid need for accurate material modelling and simulation in industry and ANN&ML based simulations will bring this purpose.
Lastly, after having the product off this challenge, the validation of data driven modelling & simulations with physical tests will illuminate most of the concerns and open points.

**Indicative Budget**
80,000K Eur

**Indicative Duration**
1 month: Data collection from manufacturing and test processes
2 months: ML & AI algorithm development to train the data collected.
2 months: Integration of the software into the CAE assembly model (digital twin model) and Quality Checks
1 month: Validation between physical tests (performed by DL) and mechanical simulation results without using the algorithm and with using the algorithm. The aim is to see the effect of the developed algorithm on mechanical properties of the digital twin part/vehicle model

**Other**
The party, that will work for this topic should be experienced on structural durability, plastic injection process in addition to their AI & ML knowledge. Mechanical damages, plastic failures and material model preparation are the key topics, which will accelerate the study.

2. **THE OPEN CALL PROCESS**

Proposals are submitted in a single stage and follow the process as presented hereafter:

*Figure 4: Open Call 2 Pilot Process*
2.1 Proposal Preparation and Submission

Proposals must be submitted electronically, using the VOJEXT Online Submission Service accessible via https://www.f6s.com/vojext-oc-2-pilot/apply. Proposals submitted by any other means, will not be evaluated. On the project website (https://vojext.eu/open-calls/) the applicant will also find the link to the form application on the F6S platform.

- The applicants are required to register a profile at FS6 to be able to submit a proposal.
- For the proposal preparation, the applicants are requested to apply online and answering to all mandatory questions.
- Participants are requested to carefully read and follow the instructions in the form.
- Follow the instructions on F6S form to download and upload the application documents:
  - Experiment schema/pitch
  - Proposal Supplement (available at https://vojext.eu/open-calls/)

Only the documentation included in the application will be considered by evaluators. It will be composed by a form with questions to be completed directly in the F6S platform.

The information provided should be actual, true and complete and should allow the assessment of the proposal. Additional material, which has not been specifically requested in the online application form, will not be considered for the evaluation of the proposals. Data not included in the proposal will not be taken into account.

- It is strongly recommended not to wait until the last minute to submit the proposal. Failure of the proposal to arrive in time for any reason, including communication delays, automatically leads to rejection of the submission. The time of receipt of the message as recorded by the submission system will be definitive.
- VOJEXT offers a dedicated support channel available for proposers at OpenCall@vojext.eu for requests or inquiries about the submission system or the call itself. Those received after the closure time of the call will neither be considered nor answered.

2.1.1 Modalities for Application

2.1.1.1 What types of projects will be eligible?

Projects must be based on the VOJEXT must clearly fit within one of the 6 challenges aforementioned in section 1.3. All 6 challenges require advancing the state of the art, hence the participation of innovators is essential.

Moreover, the participants should demonstrate their long-term commitment to the VOJEXT research and innovation agenda. The teams will work to demonstrate that the proposed solution progresses from the beginning of the project, reaching a higher maturity level and take-up by the end of the action. Thus, projects in all 6 challenges must evidence a substantial progress with a particular focus on the interoperability and sustainability of the outcomes.
At the eligibility evaluation stage, if a proposal is considered to better fit another topic selected by the applicant, this latest will be contacted by the VOJOEXT Consortium in order to commonly agree to move the proposal to the relevant topic for evaluation.

2.1.1.2 Eligibility Criteria

All Applicants will have to abide to all general requirements described in this section to be considered eligible for VOJEXT. Therefore, please read this section carefully.

An automatic filtering to discard non-eligible proposals will follow the short list. Eligibility criteria check will verify:

- The existence of a legal entity in an eligible country.
- The uniqueness of the applicant (one organisation per proposal).
- The uniqueness of the proposal (proposals that has not been developed in other EU projects).
- The alignment with VOJEXT call for rules and challenges.
- Proposals written in English.
- Submitted in the electronic submission system before the call deadline (F6S platform).
- Readable, accessible and printable.
- Complete and include the requested administrative data, and any obligatory supporting documents specified in the call.

Admissibility and eligibility criteria for each proposal are checked by the VOJEXT Consortium staff. A proposal may be declared ineligible or inadmissible at any stage.

2.1.1.3 Type of Applicants

The target applicants are SMEs and Mid-Caps. These applicants’ profiles can apply as legal entities.

- SMEs: The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million. [https://single-market-economy.ec.europa.eu/smes/sme-definition_en](https://single-market-economy.ec.europa.eu/smes/sme-definition_en)

- Mid-Caps are broadly said to have between 250 and 3000 employees which have an annual turnover exceeding EUR 50 million, and/or an annual balance sheet total exceeding EUR 43 million

The application of groups of organisations is not eligible for this call.

The participating organisations should not have been declared bankrupt or have initiated bankruptcy procedures.

The organisations applying should not have convictions for fraudulent behaviour, other financial irregularities, and unethical or illegal business practices.

The organisation is not under liquidation or is not an enterprise under difficulty accordingly to the Commission Regulation No 651/2014, art. 2.18

The organisation that was granted in previous Vojext open call (Open Call 1 Challenge) is not eligible.
2.1.1.4 Eligible Countries

Only Applicants legally established/resident in any of the following countries (hereafter collectively identified as the “Eligible Countries”) are eligible:

- The Member States (MS) of the European Union (EU), including their outermost regions (https://european-union.europa.eu/principles-countries-history/country-profiles_en?page=0)

- The Overseas Countries and Territories (OCT) linked to the Member States (https://ec.europa.eu/international-partnerships/where-we-work/overseas-countries-and-territories_en)

- H2020 associated countries (those which signed an agreement with the Union as identified in Article 7 of the Horizon 2020 Regulation): according to the updated list published by the EC (https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-list-ac_en.pdf)

- The UK applicants are eligible under the conditions set by the EC for H2020 participation at the time of the deadline of the call.

2.1.1.5 Language

English is the official language for VOJEXT open calls. Submissions done in any other language will be disregarded and not evaluated.

English is also the only official language during the whole execution of the VOJEXT programme. This means any requested submission of deliverables will be done in English in order to be eligible.

2.1.1.6 Multiple Submission

This call is competitive, and applicants should focus on one specific topic, therefore only one proposal per applicant may be submitted to this call.

In the event of multiple submissions, only the last one received (timestamp of the system) will enter into the evaluation process. Any other submitted proposals involving the same applicant will be declared non-eligible and will not be evaluated in any case.

Note that the regular functioning of the F6S platform limits to one application submission per F6S user in each call.

2.1.2 Complaint due to a technical error of the VOJEXT Online Submission Service

If you experience any problem with the application submission system prior the deadline of the open call you should reach F6S by e-mail through support@f6s.com, cc’ing the VOJEXT Team OpenCall@vojext.eu, and explain your situation.

If you believe that the submission of your proposal was not entirely successful due to a technical error on the side of the VOJEXT Online Submission Service, you may lodge a complaint by email through support@f6s.com cc’ing the VOJEXT Team (OpenCall@vojext.eu) and explain your situation. For the complaint to be admissible it must be filed within 4 calendar days following the day of the call closure.
You will receive an acknowledgement of receipt, the same or next working day. What else to do? You should secure a PDF version of all the documents of your proposal holding a time stamp (file attributes listing the date and time of creation and last modification) that is prior to the call deadline, as well as any proof of the alleged failure (e.g. screen shots). Later in the procedure you may be requested by the VOJEXT IT Helpdesk to provide these items.

For your complaint to be upheld, the IT audit trail (application log files and access log files of VOJEXT Online Submission Service) must show that there was indeed a technical problem at the VOJEXT consortium side which prevented you from submitting your proposal using the electronic submission system. Applicants will be notified about the outcome of their complaint within the time indicated in the acknowledgment of receipt. If a complaint is upheld, the secured files (provided to the IT helpdesk) for which the investigation has demonstrated that technical problems at the VOJEXT consortium side prevented submission will be used as a reference for accepting the proposal for evaluation.

2.1.3 Confidentiality and Deadline

Any information regarding the proposal will be treated in a strictly confidential manner. Only proposals submitted before the deadline will be accepted. After the call closure no additions or changes to received proposals will be taken into account. Proposals must be submitted before 7th December 2022 5 PM CET. To avoid missing the deadline, you are encouraged to submit your proposal as soon as possible.

2.1.4 Conflict of Interest

Applicants shall not have any actual or/and potential conflict of interest with the VOJEXT selection process and during the whole programme. All cases of conflict of interest will be assessed case by case. In particular, applicants cannot be VOJEXT Consortium partners or affiliated entities nor their employees or co-operators under a contractual agreement.

If a conflict of interest is discovered and confirmed at the time of the evaluation process, the proposal will be considered as non-eligible and will not be evaluated.

2.1.5 Other

Each applicant must confirm:

- It is not under liquidation or is not an enterprise under difficulty accordingly to the Commission Regulation No 651/2014, art. 2.18,
- Its project is based on the original works and going forward any foreseen developments are free from third party rights, or they are clearly stated,
- It is not excluded from the possibility of obtaining EU funding under the provisions of both national and EU law, or by a decision of both national and EU authority.
2.2 Evaluation Process

Immediately after the submission deadline (Call 2: 7th December 2022 5 PM CET) is over, the evaluation process begins (as described in detail in Section 5 of this Guide). Experts will evaluate proposals and score them adequately according to the quality of the content presented.

The evaluation process will take about 4 weeks and considers the following process:

**Eligibility Filter:** An automatic filtering to discard non-eligible proposals will follow the short list. Eligibility criteria check will verify: See the list in Section 2.1.1.2 of this guide.

**Remote evaluation:** An evaluation board from the consortium with experience in CPS and robotics technologies and business development will review each proposal, scoring them based on the following criteria:

- **Innovation:** Proposals must demonstrate innovative elements or potential to innovate in the future.
- **Excellence:** Projects must demonstrate a clear set of objectives aligned with the definition of the VOJEXT open call and with the general objectives of the project.
- **Impact:** Proposals must demonstrate potential to generate positive impacts on the VOJEXT ecosystem and to contribute to meeting the overall project objectives and European markets/trends.
- **Value:** Applicants must provide credible evidence that the company has the necessary skills and resources to carry out the project. Proposals must include a clear budget definition, detailing the overall project cost, the amount of funding requested and how it will be spent. This budget must represent good value for money in the opinion of the evaluation panel selected to evaluate the open call applications. A template to fill out is provided (The Proposal Supplement template is available at https://vojext.eu/open-calls/).
- **Project Implementation:** Applicants must define a clear set of deliverables aligned with the objectives of the open call. Applicants must provide credible evidence that the workplan and resources available will enable the project delivery in the timescales and budget specified.

The **Innovation and Excellence** are evaluated according to the following criteria:

- Clarity and pertinence of the objectives.
- Excellence, innovation and quality of the proposal.

The **Impact** is evaluated according to the following criteria:

- Potential to generate positive impacts on Vojext ecosystem by developing innovations that also meet the needs of European and global markets.

The **Value and Project Implementation** will be evaluated according to the following criteria:

- Appropriateness of the skills and experience of the company
- Coherence and effectiveness of the work plan, including appropriateness of the allocation of tasks and resources.

**Interviews:** the top proposals that succeed the remote evaluation will access the online interview. The interview aims to deeply understand the proposal concept, company skills & competence, capacity...
and willingness to exploit the results. The interviews will be carried out by the evaluation board members and will evaluate the following criteria:

- **Innovation and Excellence**: confirmation and/or better understanding of proposed targets and technology fit in.
- **Impact**: confirmation and/or better understanding the proposed solution integration with Vojext ecosystem and impacts for European markets.
- **Value and Project Implementation**: confirmation and/or better understanding of the resources available, the reliability to reach milestones and the workplan according to the programme structure (sprints and funding available).

If during interview applicants do not commit to what had been presented in application form, these will be declassified.

**Scores:**

Table 9 presents the scoring schema for both remote evaluation and interviews.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Excellence and Innovation</td>
<td>40%</td>
<td>Score (1,00 - 5,00) - Threshold 3,00</td>
</tr>
<tr>
<td>2. Impact</td>
<td>30%</td>
<td>Score (1,00 - 5,00) - Threshold 3,00</td>
</tr>
<tr>
<td>3. Value and Project Implementation</td>
<td>30%</td>
<td>Score (1,00 - 5,00) - Threshold 3,00</td>
</tr>
<tr>
<td>Total Score</td>
<td></td>
<td>The maximum overall score is 10. The minimum threshold, applying to the sum of the 3 individual scores with the corresponding weight is 5.</td>
</tr>
</tbody>
</table>

*Table 9: Scoring – Remote Evaluation and Interviews*

The final scoring represents the average value of remote evaluation and interview scores.

*Table 10: Score Details*

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The proposal fails to address the criterion under examination or cannot be judged due to missing or incomplete information.</td>
</tr>
<tr>
<td>2</td>
<td>The criterion is addressed in an unsatisfactory manner. There are serious inherent weaknesses</td>
</tr>
<tr>
<td>3</td>
<td>While the proposal broadly addresses the criterion, there are significant weaknesses that would need correcting.</td>
</tr>
<tr>
<td>4</td>
<td>The proposal addresses the criterion well, although certain improvements are possible.</td>
</tr>
<tr>
<td>5</td>
<td>The proposal successfully addresses all relevant aspects of the criterion in question. Any shortcomings are minor.</td>
</tr>
</tbody>
</table>
**Consensus meeting and Final selection:** After the interviews, evaluators will come together with the purpose of discussing the evaluated proposals. At the end of the evaluation process, all proposals will be selected or not based on their scores. The list of accepted proposals at remote evaluation will be elaborated as well as the information about the non-eligible proposals. All applicants will be informed about the evaluation results by email.

All evaluators will receive the evaluation guidelines, templates, and will be duly informed about the timing for an agile process and conflict of interest issues. Also, the evaluators will sign a declaration of impartiality and no-conflicts of interest.

The VOJEXT consortium then formally approve a list of projects within the limits of the available funding.

**Communication of Results:** Regarding the communication of the results, each applicant will receive via e-mail an evaluation summary report informing of the decision whether a rejection decision or an invitation to negotiation and following steps.

### 2.3 Sub-Grant Agreement

All the legal issues are accurately covered by the planned contracts with the sub-granted beneficiaries. A written Sub-grantee agreement will be signed with successful applicants. It will foresee, among other things the special clauses derived from H2020 in cascading granting, the payment schedule and conditions (milestones), general legal text issues of rights and obligations by the VOJEXT consortium and each sub-grantee, including IPR and audit procedures.

The sub-grantee agreement will also have a set of annexes like bank account information form, declaration of honour, SME qualification document and any other document required by VOJEXT to assure the correct execution of the sub-granted projects.

A legal entity that does not provide the requested data and documents in due time will not be included in VOJEXT Acceleration Programme.

**The Negotiation Process:** The objective of the negotiations is to fulfil the legal requirements between the VOJEXT consortium and each selected project of the call. It covers essentially the status information of the beneficiaries. The legal requirements for legal entities are provided in the table hereafter.

---

**Table 11: Legal Requirements for legal entities**

<table>
<thead>
<tr>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A legal existence:</strong></td>
</tr>
<tr>
<td>Company Register, Official Journal and so forth, showing the name of the organization, the legal address and registration number and, if applicable, a copy of a document proving VAT registration (in case the VAT number does not show on the registration extract or its equivalent)</td>
</tr>
<tr>
<td><strong>Specifically for SMEs:</strong></td>
</tr>
<tr>
<td>1. A proof of the SME condition is required:</td>
</tr>
<tr>
<td>- If the applicant has been fully validated as an SME on the Beneficiary Register of the H2020 Participant Portal, the PIC number must be provided.</td>
</tr>
<tr>
<td>- If the applicant has not been fully validated as an SME on the H2020 Participant Portal, the following documents will be required to prove the status as an SME:</td>
</tr>
</tbody>
</table>
2. In the event the beneficiary declares being non-autonomous, the balance sheet and profit and loss account (with annexes) for the last period for upstream and downstream organizations is required.

3. Status Information Form. It includes the headcount (AWU), balance, profit & loss accounts of the latest closed financial year and the relation, upstream and downstream, of any linked or partner company.

4. Supporting documents. In cases where either the number of employees or the ownership is not clearly identified: any other supporting documents which demonstrate headcount and ownership such as payroll details, annual reports, national regional, association records, etc.

**Bank account information:**
The account where the funds will be transferred will be indicated via a financial information form signed by the entity, individuals and the bank owners. The holder of the account will be the legal entity and/or all the individuals or the coordinator of the group on its own (consortium of legal entities or consortium of legal entities and natural persons) if allowed by the other team members.

**Sub-grantee funding agreement:**
Signed between the VOJEXT Consortium (represented by its coordinator European Dynamics), and the beneficiary/ies.

The information request, by the VOJEXT consortium will be done including deadlines. Failing to meet the deadlines requested will directly end up the negotiation process.

**Scientific Misconduct and Research Integrity:** Issues of scientific misconduct and research integrity are taken very seriously. In line with the Horizon 2020 Rules for Participation, appropriate action such as termination of the Grant Agreement Preparation phase or, if the Grant Agreement has been signed, the implementation of liquidated damages and financial penalties, suspension of payments, recoveries and termination of the Grant Agreement, will be taken against any applicants/beneficiaries found to have misrepresented, fabricated or plagiarised any part of their proposal.

**Intellectual Property Rights (IPR):**

- **IPR ownership of the sub-granted projects**
The ownership of all IPR created by the beneficiaries, via the VOJEXT funding, will remain with them. Results are owned by the Party that generates them. The Sub-Grant Agreement will introduce provisions concerning joint ownership of the results of the sub-granted projects. This will be assessed and negotiated case by case.

- **Communication obligations**
There are no IPR obligations toward the European Commission (EC). However, any communication or publication of the beneficiaries shall clearly indicate that the project has received funding from the European Union via the VOJEXT project, therefore displaying the project logo on all printed and digital material, including websites and press releases. Moreover, beneficiaries must agree that certain information regarding the projects selected for funding can be used by VOJEXT consortium for communication purposes.
2.4 Deployment Programme

The selected projects will engage with VOJEXT consortia as third parties for up to 7 months depending on the challenge and proposed project duration. The projects implementation will start around M33 (March 2023) and be divided in 2 Sprints of 3-3.5 months. Awarded SMEs and mid-caps will have access to the simulation platform and the test bed for open calls.

At the end of each Sprint third parties will need to provide specific deliverables. This approach enables:

(i) a proper follow up of projects activities and understanding of projects evolution/implementation.

(ii) the execution of partial payments according to third-parties performance.

The overall programme structure will be detailed right after the kick-off meeting of the programme. It includes the definition of monitoring meetings, the presentation of the tech team that will support the organisation during the programme period, follow-up schema, presentation of administrative documents templates and access to technical documents.

At the end of the programme, all participant companies will be invited to demonstrate the final solutions and report the main outcomes.

3. FINANCIAL SUPPORT OF PROVIDED

The distribution of the indicative budget of the call will be proportional to the number of eligible proposals received for each challenge/experiment.

The amount of financial support will be calculated based on estimated costs. Each third-party application will include the need and justifications of costs and resources in a template provided during the application procedure.

The total grant requested by the third parties will represent up to 70% of the total costs of the project.

Checking the consistency between these costs and the expected work of the project will be part of the evaluation process in the submission stage.

The fund division is structured as:

<table>
<thead>
<tr>
<th>Open Call</th>
<th>Phase</th>
<th>Amount (in Euros)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#2</td>
<td>Sprint 1</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>Sprint 2</td>
<td>60%</td>
</tr>
</tbody>
</table>

Third parties will receive funding upon the execution of specific activities/deliverables. Payments will be made according to a staged payment arrangement based on the successful completion of specified milestones and reviews.

**Origin of the Funds:** Any selected proposer will sign a dedicated Sub-Grant Agreement with the VOJEXT project coordinator (on behalf of VOJEXT Consortium). The funds attached to the Sub-Grantee Funding Agreement come directly from the funds of the European Project VOJEXT, and the VOJEXT consortium is managing the funds according to the Grant Agreement Number 952197 signed with the European Commission.
As will be indicated in the Sub-Grant Agreement, this relation between the sub-grants and the European Commission through VOJEXT project carries a set of obligations to the sub-grants with the European Commission. It is the task of the sub-grants to accomplish them, and of the VOJEXT consortium partners to inform about them.

4. INDICATIVE TIMETABLE

The table below presents the indicative dates during which each phase of VOJEXT Open Call #2 will take place.

<table>
<thead>
<tr>
<th>Description</th>
<th>Indicative Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Announcement</td>
<td>5th October 2022 at 12:00 PM CEST</td>
</tr>
<tr>
<td>Submission Deadline</td>
<td>7th December 2022 at 5 PM CET</td>
</tr>
<tr>
<td>Evaluation Period</td>
<td>December-January</td>
</tr>
<tr>
<td>Results announcement</td>
<td>Mid-January 2023</td>
</tr>
<tr>
<td>Signature of Sub-grant Agreement</td>
<td>February 2023</td>
</tr>
<tr>
<td>Implementation of the funded projects</td>
<td>March 2023-August 2023</td>
</tr>
</tbody>
</table>

5. APPLICANTS COMMUNICATION FLOW

**General Communication Procedure:** The applicants will receive communications after the evaluation process indicating the results. A communication will be sent to applicants rejected including the reasons for the exclusion and to selected applicants.

**Appeal Procedure:** If, at any stage of the evaluation process, the applicant considers that a mistake has been made or that the evaluators have acted unfairly or have failed to comply with the rules of this VOJEXT Open Call, and that her/his interests have been prejudiced as a result, the following appeal procedures are available.

A complaint should be drawn up in English and submitted by email to: OpenCall@vojext.eu

Any complaint made should include:

- Contact details.
- The subject of the complaint.
- Information and evidence regarding the alleged breach.

Anonymous complaints or those not providing the mentioned information will not be considered.

Complaints should also be made within five (calendar) days since the announcement of the evaluation results to the applicants.
As a general rule, the VOJEXT Team will investigate the complaints with a view to arriving at a decision to issue a formal notice or to close the case within no more than twenty days from the date of reception of the complaint, provided that all the required information has been submitted by the complainant. Whenever this time limit is exceeded, the VOJEXT Consortium will inform the complainant by email of the reasons for the unforeseen delay and the subsequent steps.

6. CHECKLIST

1. Does your planned work fit with the call for proposals? Check that your proposed work does indeed address one of the challenges open in this call.
2. Is your proposal eligible? The eligibility criteria are given in Section 2.1.1 “Modalities for Application”. In particular, make sure that you satisfy the eligibility criteria. Any proposal not meeting the eligibility requirements will be considered ineligible and will not be evaluated.
3. Budgetary limits. Check that you comply with any budgetary limits of each challenge as expressed in section 1.3 tables.
5. Does your proposal fulfil questions requests? Proposals should be precise, concise and must answer to requested questions, which are designed to correspond to the applied evaluation. Omitting requested information will almost certainly lead to lower scores and possible rejection.
6. Have you maximised your chances? There will be strong competition. Therefore, edit your proposal tightly, strengthen or eliminate weak points.
7. Have you submitted your proposal before the deadline? It is strongly recommended not to wait until the last minute to submit the proposal. Failure of the proposal to arrive in time for any reason, including network communications delays, is not acceptable as an extenuating circumstance. The time of receipt of the message as recorded by the submission system will be definitive.
8. Do you need further advice and support during the proposal phase? You are strongly advised to communicate with the VOJEXT team (See sections 7 and 8).

Do not forget that it is mandatory the coordinating SME or Mid-Cap to have a valid VAT number during negotiation time.

7. SUPPORT FOR THE APPLICANTS

For more information about the VOJEXT Open Calls, please check the open call section at https://vojext.eu/open-calls/ where you will find the application material and instructions to apply.

For further information on the Open Call, in case of any questions regarding the open call rules, please contact OpenCall@vojext.eu. If you encountered technical issues or problems with the Application Form, please contact support@f6s.com, cc’ing OpenCall@vojext.eu, and explain your situation.

8. POINTS OF CONTACT

The VOJEXT consortium will provide information to the applicants only via the F6S blog, so that the information (question and answer), will be visible to all participants.

No binding information will be provided via any other mean (e.g. telephone or email).

More info at: https://vojext.eu/open-calls/
ANNEX 1 – CHALLENGE 6 – TECHNICAL SPECIFICATIONS

Mercedes Benz Türk (MBT) aims to investigate plastics in two phases: firstly, by understanding inner material flow and manufacturing parameters and thus secondly the mechanical behavior while gripping and transferring though a pathway. Below there are some information which describes initial situation of both production and handling processes from MBT perspective.

Fundamentals of Injection Molding

Injection Molding Process:

Mold Closes:
Holding Phase:

- When mold is full, switch-over to pressure-controlled holding phase, ensures that the volume shrinkage during cooling, is compensated.
- During holding up to 10% of the volume is transferred into mold.

Dosing Phase:

- Melting and homogenization of material for the next cycle
- Transport the melt into the antechamber

Ejection:

- Part ejected
- Cooling to ambient temperature while outside mold
- Shrinkage might continue.
Measurement of Pressure in Injection Molding:

The composition, appearance, and process of a hydraulic injection-molding machine (IMM).