Improving productivity and product quality through applying cobots in assembly processes

Project title	**Improving productivity and product quality through applying cobots in assembly processes**		
Project related to the previous concept			
PC No	-	**PC title**	Product for replacing repetitive tasks (Company 1)
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Kind of project	**Area of industrial modernisation covered by the project**
Investment project	Robotics & Artificial Intelligence in production processes

Project consortium			
Project leader (company name)	[to be decided]	**Cluster**	
Project partner	Company 1 (Bulgarian SME)	**Cluster**	ACB
Project partner	Company 2 (Polish supplier)	**Cluster**	SAAM
NOTE: Looking for partners from other regions to join the project			

Main issues covered in the project	
Scope	The aim of the project is to increase productivity and product quality (less waste) by way of introducing one or more cobots providing assembly operations together with operators for a portfolio of components. The cobots should be easily programmable and configurable according to the requirements of several projects. Case study at Company 1: • One of the reference projects concerns assembly operations of metal parts into plastic components. • 6 operators are engaged in the assembly process during one shift. • The current cycle time of the operation: 25 sec. to place 5 metal parts on a plastic component. • Currently the operator provides information in the system (scanning) which parts are OK and which are not OK. • The cobots should take over repetitive tasks with the aim to diminish cycle time. • A reshaped process, which could allow realizing orders/projects in a shorter period of time, should be considered.
Building blocks of the solution	1. The assembly process (the steps, the ergonomic aspects, internal logistics before and after the assembly operation) – possible a new assembly process could be defined based on the introduction of cobots, internal logistics and picking and placing operations 2. The possibility to do different assembly operations for different components in the same workstation 3. The material flow, the tasks to be done by the cobots and the tasks to be done by the operators 4. The space in which the cobot(s) should cooperate with the operators (movement, safety, environmental conditions) 5. The size and weights of the components (up to 3 kg), the reach to be secured (from the table or from a bin randomly) 6. The size of the boxes at in- and out-stages (picking and placing, packaging) 7. A virtualised process to simulate the workflow and activities done by a cobot (virtualisation could allow to quickly verify the feasibility of new projects based on order/project related parameters) 8. A mounted camera for random bin picking (technical and financial feasibility to be checked) 9. A mounted camera for quality control check or a stand-alone camera for quality control check (technical and financial feasibility) – taking into account that components have glossy parts (metal parts) (light interference, stability of conditions) 10. A counting system (interface with ERP or stand-alone) of OK/Not OK parts 11. Optional (to be verified concerning financial feasibility and productivity increase) – packaging operations done manually or by cobot.

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Financial aspects	The costs of the investment project can be roughly estimated on the basis of a video description of the process and a virtualised concept of the assembly process including the cobots, prepared by a supplier. Case study at Company 1: the company will make a video description of the assembly process available for suppliers/integrators after having signed an NDA. Expected return on investment around 3-4 years.
Staff and competencies	The introduction of cobots in the assembly process demands for the following competencies in the team: • Ability of operators to cooperate with cobots (psychological and sociological aspects, health and safety aspects); • Competencies in assessing risks related to the tasks to be provided by the cobots (health, safety, mechanical issues, material issues) • Competencies related to programming of cobots for specific tasks.
Risk analysis	• Risk of non-acceptance by the operators of cobots on the shop floor. Mitigation: involvement of the operators in the planning activities, clear information about the new tasks for the operators in the company, pilot testing and ergonomics assessment in cooperation with the operators. • Risk of lack of flexibility of the cobot configuration. Mitigation: evaluation of future opportunities to apply the cobots in other projects – an overall idea of the need for cobots should be assessed before deciding about the investment. Assessment of potential application areas of the cobots including the need for additional tools (for instance cameras) and end-effectors. • Risk that future parts cannot be assembled by a cobot because of technical, mechanical, ergonomic issues. Mitigation: preparation of a proof-of-concept by the supplier based on the parts and the defined assembly process. • Risk of underestimation of the investment budget. Mitigation: the supplier should have access to information about the process and the conditions in the company in order to get insight in the process, insight in the product quality requirements, insight in the cycle time, insight in the environmental aspects (temperature, humidity).

Main activities covered in the project	
Pre-project analysis Defining the financial feasibility and the conditions in the company	1. Preparation of a video describing the process by the company 2. Analysis of the process by the supplier to verify the possibility of diminishing the cycle time 3. Preparation of a virtualised process by the supplier 4. Verification of the costs aspects (cobots, supporting tools, internal logistics, safety areas, end-effectors, cameras, tasks to be done by the cobots) by the supplier 5. Approval of the concept and the budget by the company 6. Description of the technical requirements and specifications for the investment project
Pre-project agreement	Depending on the approach: 1. In case of the company applying for regional or national grants no agreements should be signed with a supplier wanting to deliver the equipment. It is possible to engage an expert/supplier at the stage of preparing the technical requirements for the investment if these need to be included in the grant project proposal. 2. In case of the company applying for a grant under an international support scheme that allows companies and suppliers to enter into consortia in order to tackle concrete industrial modernisation issues, the parties can sign an agreement to exchange information (NDA) and to look for financing.
Project activities	
1. Defining the technology challenges	Case study at company 1: • The cobots will perform repetitive assembly tasks. • The cobots will have several end-effectors depending on the kind of order/project. • The cobots will be placed in a specific workstation (not mobile). • The cobots will be responsible for random picking components from a box, placing, checking, assembling, checking and placing in boxes. • A camera that recognises if the part put in front of the cobot is placed correctly in order to allow the cobot to commence its tasks (High definition camera that can identify parts in a box, the robot can take the random part and prepare the part before staring the assembly operations). • A camera that recognises if the metal parts are placed correctly in the plastic component (3D camera and robot that can check "forces" or additional camera with picture reference to check the right assembly). • A counting system to count OK and not-OK parts (two options: an interface to connect the cobot-operations to the ERP-system or to foresee an xml.database as a standalone solution).
2. Preparation of a Proof of concept	[depending on the scenario chosen by the parties – participation in a regional or national investment grant scheme or participation in a European programme on industrial transformation]

Expected results of the project
• A new assembly process defined • A workstation with one or more cobots providing assembly operations together with operators for a portfolio of components • Diminished cycle time • Diminished scrap • Increased productivity