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# Identification and prioritisation of professional transitions in manufacturing operations in the new context of Industry 4.0

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**Abstract.** This paper examines the results from the identification and prioritisation phase of professional transitions towards the requalification of digital job operators. It was developed as part of the ‘Learning Solutions for Employability’ project, which seeks to develop and test learning solutions to improve, accelerate and make lifelong learning processes more sustainable, as well as to support people with low employability in their professional transitions within the MONDRAGON Corporation. The analytical process was applied to seven companies from different industrial divisions of the MONDRAGON Corporation. The competencies identified mainly correspond to the acquisition of basic digital skills to use new tools. These mainly affect approximately 1,800 people integrated into the groups with the highest impact of digitalisation, such as assembly and production line operators.

**Keywords:** Digitalisation; Manufacturing; Industry 4.0; Employment; New skills

## 1 Introduction

The fourth industrial revolution, also called Industry 4.0, has undergone a transformation in industrial processes to make more efficient and productive. This transformation requires a major shift in workforce skills, organisational structures, leadership mechanisms and corporate culture [1]. However, it has resulted in a decreasing demand for low-skill jobs, and presents greater potential for automation, as well as operations that rely on pre-specified, routine physical activities, data collection and processing [2, 3]. In this context, job automation is increasing, and new jobs are simultaneously emerging that require new digital skills. For all these

reasons, to prepare for these imminent changes and to ensure their productivity and competitiveness within the Industry 4.0 era, industrial companies' staffs must develop and adapt to new skills. Developing these new competencies involves not only attracting, recruiting and developing the workforce of the future, but also retraining current employees through training programmes and redesigning work processes to reduce job mismatches and reduce incongruence between jobs, skills and employees [4]. Numerous studies have been conducted in an attempt to address the issue of the number of jobs that could be displaced by substituting human work with machines. [1, 2]. These studies forecast that around 30–40% of jobs in advanced economies will be at risk within the next 15–20 years, and that the need for manual and physical skills, as well as basic cognitive skills, will decrease, but that the demand for technological, social and emotional skills will increase [6]. There are numerous studies on how these new competencies may be developed for the new Industry 4.0 context. It is noteworthy that the McKinsey study identified 56 skills grouped into 4 general groups: cognitive, interpersonal, self-leadership and digital competencies [6].

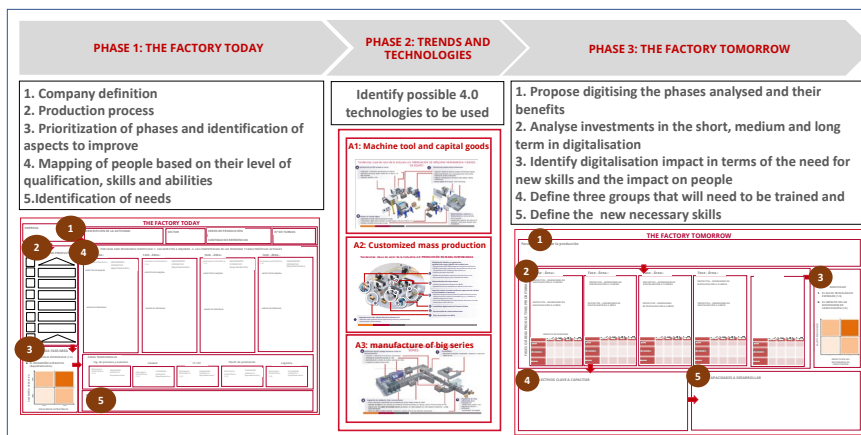
**Table 1.** Categories of new skills used in the study (Adapted [6] [7])

Categories	Skills groups	Foundational skills
General digital skills	Digital fluency and citizenship	<ol style="list-style-type: none"> <li>1. Digital literacy</li> <li>2. Digital collaboration</li> <li>3. Digital learning</li> <li>4. Digital ethics</li> </ol>
	Software use and development	<ol style="list-style-type: none"> <li>1. Programming literacy</li> <li>2. Computational and algorithmic thinking</li> <li>3. Data analysis and statistics</li> </ol>
	Understanding digital systems	<ol style="list-style-type: none"> <li>1. Data literacy</li> <li>2. Cybersecurity literacy</li> <li>3. Smart systems</li> <li>4. Tech translation and enablement</li> </ol>
Specific digital skills	Industry 4.0 technologies	<ol style="list-style-type: none"> <li>1. Big data-driven quality control</li> <li>2. Robot-assisted production</li> <li>3. Self-driving logistics vehicles</li> <li>4. Production line simulation</li> <li>5. Smart supply networks</li> <li>6. Predictive maintenance</li> <li>7. Machines as a service</li> <li>8. Self-organised production</li> <li>9. Additive manufacturing</li> <li>10. Augmented work</li> </ol>

In the case of this study, as shown in Table 1, the focus is placed on the development of general digital skills that are related to general behaviours towards the aforementioned systems and the specific digital skills that are related to the knowledge and use of Industry 4.0 technologies [7]. Given the context of growing business complexity and digital transformation, it is anticipated that the MONDRAGON Corporation companies will need to requalify their staffs with a higher risk of digital exclusion to adapt to digital transformation requirements of their productive processes. This paper demonstrates the results from the identification and prioritisation phase for professional transitions towards the requalification of digital job operators. It was developed as part of the ‘Learning Solutions for Employability’ project, which seeks to develop and test learning solutions to improve, accelerate and make lifelong learning processes more sustainable, as well as to support people with low employability in their professional transitions within the MONDRAGON Corporation.

## 2 Methodology

The methodology followed is based on the one developed by Behrendt [6], which states that to address the integration of digitalisation skills and competencies throughout the organisation, it is necessary to have a holistic vision in which businesses, organisations and technologies are integrated. To this end, the research team has organised work sessions within the companies analysed in which those responsible for human resources, IT, production and industrial directors have participated.



**Figure 1:** Methodology applied in field work

As can be seen in Figure 1, the methodology used is structured into three phases for which specific templates have been developed to collect information based on the questions to be answered.

Phase 1: The factory today: The objective of this phase is to identify the

characteristics of the company today. To do this, first, the type of product manufactured was identified, as well as the sector to which the company belongs. Subsequently, the critical phases of the production process were identified through a multicriteria analysis based on the strategic level of the phase analysed and its capacity for improvement. Afterwards, workers were mapped for each phase identified above based on their level of training and their competencies and skills. Finally, the opportunities for improvement or the needs of the process analysed were identified.

Phase 2: Trends and technologies: In this phase, the possible Industry 4.0 technologies to be used are identified and analysed. To this end, the three production archetypes and the application of Industry 4.0 technologies proposed by the company have been taken as a basis in which Industry 4.0 technologies are identified for the three most common archetypes in industrial processes: A1: machine tool and capital goods, A2: customised mass production and A3: manufacture of big series [9]

Phase 3: The factory tomorrow: In this phase, the new profiles and skills to be developed are identified. First, a reflection is made concerning why it is necessary to digitalise the process based on the information previously collected. Then, an analysis of the investments in digitalisation in the short, medium and long terms is conducted. Next, a multi-criteria matrix is used to analyse the impact of digitalisation on people. Finally, the groups that need to acquire new skills, as well as the new skills to be developed, are identified.

### **3 Results and discussion**

The analytical process was applied to seven companies (C) from different industrial divisions of the MONDRAGON Corporation, and it was conducted in November and December 2021. Below is a summary of the companies' most important characteristics, digitalisation strategies, digital skills identified and the profile of affected personnel:

C1. Medical devices sector: The company must meet strict quality standards and approval processes, as well as ensure products' traceability to protect their monitoring throughout their life cycle. The main digitalisation strategy to be addressed is the development of digital supports to facilitate tasks and monitor management and operational processes. The digital competencies identified for development correspond to the acquisition of basic digital skills and the development of tools and techniques to speed up training processes. Future retraining needs now affect the people integrated into the warehouse and production operator groups.

C2. Electrical appliance auxiliary components: The company has two lines of business with a wide variety of machines, with maintenance of installations being a key variable when measuring the efficiency of the business. The main digitalisation strategy is the development and implementation of a preventive and corrective maintenance management system for the company's facilities. The digital competencies identified for development correspond to the acquisition of skills in

data understanding and management for technicians and managers with the aim of speeding up and improving their use. Future retraining needs have affected the people integrated into maintenance technician and process manager groups.

C3. Automotive auxiliary components: The company focuses on manufacturing varied and large series of components, and it faces increasing market demands in terms of quality, delivery time and service. The company has a constant need to increase its productivity and flexibility and overcome its products' strict homologation processes. The main digitalisation strategy should be aimed at developing digital jobs in the manufacturing sector to facilitate tasks and monitor processes. The digital competencies identified for development correspond to the acquisition of competencies in the development of digital skills and abilities, as well as to the acquisition of basic knowledge and habits in the use of digitalisation technologies, which allow operators to efficiently manage manufacturing areas. Future retraining needs affect the workers integrated into the groups of assembly and production operators.

C4. Automated capital goods: The company's products and markets create the need for very flexible production planning. Product customisation, lack of foresight and short delivery times make planning a complex task. Principal digitalisation strategies should be aimed at developing digital support to facilitate tasks and monitor management and operational processes. The digital skills identified for development correspond to line operators' acquisition of basic digital skills. Future requalification needs affect the people integrated into the groups of assembly line workers.

C5. Cold equipment manufacturing company: The company in question has two business lines: one corresponding to the manufacturing of standard products and the other to the manufacturing of customised products. The typology of products and markets makes for very flexible production planning necessities. The main digitalisation strategy should be aimed at implementing and deploying an enterprise resource planning (ERP) system as a basis for applying solutions to improve operational efficiency. Digital competencies are those related to the acquisition of digital skills for the implementation and deployment of the ERP system and basic digital skills for using new tools. Future requalification needs affect the workers integrated into groups of planning technicians and assembly line workers.

C6. Machinery manufacturing company: This company manufactures customised machinery with a high level of standardisation and small series production. As for the main digitalisation strategies, they should be aimed at the development of digital support to facilitate tasks and monitor the management and assembly operating processes. The digital skills identified for development correspond to the development of basic and general digital skills. Future requalification needs affect the people integrated into groups of assembly operators.

C7. Special automatic machinery: This company manufactures special machinery adapted to the manufacture and assembly of products for different sectors. Each project is usually different; thus, workers constantly adapt to market requirements. The great challenge facing this company is the need to increase the manufacturing efficiency of its special, custom-made machines'. For this purpose, special attention is paid to project management and decision-making among the project team. The

main digitalisation strategy should be aimed at creating digital jobs in which it would be possible to track assembly times and data in real time for subsequent data analysis. The digital skills identified for development correspond mainly to the development of specialist profiles for the use of digital tools and support for project management and the assembly process. Future requalification needs affect the people integrated into groups of assembly workers and project managers.

## 4 Conclusions

A simple method was designed and applied that to allow for the identification and prioritisation of professional transitions for the requalification of operators of jobs affected by digitalisation processes. The skills to be developed and the groups to be requalified have also been identified. The competencies identified mainly correspond to the acquisition of basic digital fluency skills for using new tools. These mainly affect approximately 1,800 people integrated into groups with the highest impact of digitalisation, such as assembly and production line operators. Furthermore, the work has allowed for the identification of the typology of courses and training programmes to be developed during the project's second phase.

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