

Digit-Fur

Impacts of the digital transformation in the wood furniture industry

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DETAILED IMPACTS ON OCCUPATIONAL PROFILES



Aspects taken into account for the occupational profiles analysis

The first of the next sections presents the forecast of the percental volume jobs change in the wood furniture sector due to its digitization in 2025. The other following three sections include short descriptions/explanations of the concepts that were used to assess the changes produced by the wood furniture industry

digitization: McKinsey levers, industry 4.0 technologies, wood furniture industry risks and hazards, and finally skills, knowledge and competences. Their clear comprehension is needed to properly understand the section tables.

Workers volume changes expected for 2025

At overall level, to understand the sector jobs structure and their related relevance, we analysed as well the impact of digitization on the volume of the different jobs categories and the targeted occupational profiles. The table below provides an overview of

furniture sector jobs functions categories, their approximate volume in 2014, and their link with the occupational profiles targeted, the values of automation probability, and the expected change of workers volumes in 2025 due to sector digitization.

Table 4.- Workers volume changes expected for 2025

Job function categories ¹	Approx. vol. in 2014 ²	Professional profiles targeted by DIGIT-FUR (ESCO occupational profiles)	% Automation probability ³	Expected change for 2025 ⁴
Managers	66.886	No covered by this study	-	-
ICT Professional	9.555	No covered by this study	-	-
Designers	9.000	2163s Furniture Designer	2,9%	+ 1,1%
Production manager	19.110	1321s Industrial production manager	3,0%	+ 4,3%
Sales and marketing staff	19.110	1221s Sales and marketing managers + additional profiles not covered by this study	1,4%	+ 3,8%
Supply chain managers	9.000	1324s Supply Chain manager	59,0%	- 1,0%
Administrative support staff	95.552	No covered by this study	-	-
Plant and machinery maintenance and repair workers	57.331	2141s Maintenance & repair engineer + additional profiles not covered by this study	2,9%	+ 3,2%
Skilled handicraft workers (Cabinet Makers and Upholsterers)	477.761	7522 Cabinet-makers and related workers	91,5%	- 0,9%
		7534 Upholsterers and related workers	15,9%	- 3,2%
		8219s Furniture assembler	97,0%	+ 2,7%
Machine operators	38.221	7523 Woodworking-machine tool setters and operators	97,0%	- 0,9%
		8172 Wood processing plant operators	86,0%	- 0,9%
Labourers	66.886	9329 Factory hand	74,8%	- 0,9%

¹ Jobs functions categories from the study TNO, ZSI, SEOR (2009), EC.

² 955.521 workers, EU 28 Furniture Sector total number of workers according to EUROSTAT data.

³ Automation probability refers to the likelihood a human job and/or its tasks are undertaken by a machine thanks to the development of new technologies. Data from Hernández (2018).

⁴ Expected change in workers volume in 2025 due to sector digitization Based on elaboration of Vogler-Ludwig (2016) data.

McKinsey levers and industry 4.0 technologies

We can find on the right short descriptions of the McKinsey levers and industry 4.0 technologies. They will help to properly understand the tables presenting the tasks changes for each of the analysed occupational profiles.

Consultancy firm McKinsey created the "digital compass" identifying 26 practical Industry 4.0 levers that are changing (and will change further) the companies functioning and production processes. We selected 23 of these levers affecting the production process targeted by DIGIT-FUR project.

Smart energy consumption

Monitoring the energy consumption throughout the entire manufacturing system allows optimizing the consumption from the perspective of the whole system.

Real-time yield optimization

Real-time optimization (RTO) is a type of closed-loop control system able to automatically regulate a process optimizing its performance in real time.

Intelligent IoTs

The industrial Internet of Things is the interconnection through Internet of devices embedded in objects and machines, enabling them to send and receive data to company's information systems.

Routing flexibility

Ability of more than one machine to perform the same process or adjust for changes in capacity or volume.

Machine flexibility

Ability of the machine to reconfigure and do more than one task.

Remote monitoring and control - asset utilization

Remote monitoring is the process of supervising and controlling systems using locally installed agents that can be accessed by a distant service provider.

Predictive maintenance

Predictive maintenance techniques can help determine the condition of in-service equipment in order to predict when maintenance should be performed.

Augmented reality for MRO (Maintenance, repair, and operations)

Augmented reality is a live indirect view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video or graphics on top of the real world.

Human-robot collaboration

A collaborative robot, or cobot, is a robot intended to physically interact with humans in a shared workspace.

Remote monitoring and control - labour

Remote monitoring is the process of supervising and controlling systems using locally installed agents that can be accessed by a distant service provider.

Automation of knowledge work

Advances in artificial intelligence, machine learning and natural user interfaces (voice, video, text etc.) are making it possible to automate many current knowledge worker tasks.

Digital performance management

Digital performance management includes activities which ensure that pre-set goals are consistently being met in an effective and efficient manner.

Batch size 1

It is the ability of doing mass customisation to a batch size of 1.

Real-time SC optimization

Availability of real-time data, including the entire supply chain, allows for optimisation of asset utilization along the entire production process.

In situ 3D printing

In situ 3D printing is the ability to produce components in a distributed manner – on site.

Digital quality management

Digital quality management ensures that a process, a product or service are consistent. It typically has four components: quality planning, quality assurance, quality control and quality improvement.

Statistical process control (SPC)

Statistical process control is a quality control method. It uses massive amounts of data and statistical models to monitor and control the different processes.

Advanced process control (APC)

Advanced process control is an add-on to more basic control mechanics and can involve a broad range of technologies and techniques.

Data-driven demand prediction

The ability to predict customer demands before they happen, based on solid data.

Data-driven design to value

Designing products not only for functionality but also for value, based on real data.

Rapid experimentation and simulation

Rapid experimentation refers to a set of techniques used to quickly fabricate a scale model of a physical part or assembly using three-dimensional computer aided design modelling or additive manufacturing.

Customer co-creation/ open innovation

Creating products in processes where the customer is fully integrated.

Concurrent engineering

Concurrent engineering is an engineering methodology emphasizing the parallelisation of tasks.

Moreover, there is a set of evolving technologies that are currently widely recalled as the key ones to be adopted by industries to implement their digital transformation and generally are defined as the industry 4.0 technologies.

Big data and analytics

The extraction of new information from massive amounts of data using machine learning software algorithms.

Autonomous robots

Autonomous robots and machines that are able to make their own decisions on how to operate in a particular situation.

Simulation

Accurate predictions of how elements behave.

Horizontal and vertical system integration

The accumulated effect of the convergence of the new digital technologies accelerating the impact of the digital transformation.

The industrial internet of things

The network communication technology providing the necessary connectivity to have access to all relevant data is referred to as the Industrial Internet of Things.

Cybersecurity

Cyber threats can hit any part of the manufacturing chain as well as the actual smart products itself.

The cloud

Cloud computing is a shared pool of configurable computer system resources and higher-level services that can be rapidly provisioned with minimal effort.

Additive manufacturing

Additive manufacturing is any of various processes in which material is joined or solidified under computer control to create a three-dimensional object.

Augmented reality

A live indirect view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video or graphics on top of the real world.

Risks and hazards in the wood furniture industry

Woodworking in the furniture industry can be hazardous for workers. From the use of machinery and tools, handling heavy materials to exposure to dust, noise and chemicals – potentially harmful events can happen at any time. These events can affect the health of workers, for example causing them to suffer skin and respiratory diseases, or injuries such as a loss of fingers or even death.

The Table 5 shortly describes the different kinds of hazards that workers of wood furniture production companies can face. It is the product of our OHS external expert, based on different sources of information. We highlighted in RED, the new hazards due to the sector digitization in 2025.

Table 5.- Common and new risks and hazards in the wood furniture industry

Different categories of hazards	Hazards details for each category and short description
Mechanical hazards	
<ul style="list-style-type: none"> ▪ Unprotected moving parts (cobotics), (Squeezing, bumping, crushing, cutting, amputation, drawing-in/trapping) ▪ Parts with hazardous shapes (cutting, pointed, rough) ▪ Moving means of transport and tools (run over, roll over, falls from height) ▪ Uncontrolled moving parts (flying objects, wood chips) 	<p>Hand and power tools: Risk of stabs, cuts, amputations of fingers from hand and power tools.</p> <p>Unprotected moving parts: Risk of entanglement of body parts into rotating parts or machinery.</p> <p>Flying objects: Risk of eye injury from flying particles (wood chips, broken tools, metal parts).</p>
<ul style="list-style-type: none"> ▪ Slip and trips 	Slips and trips and falls from heights.
<ul style="list-style-type: none"> ▪ Falls from height 	Risks of slips, trips and from slippery surfaces, stairs, obstacles on walkways, poor lighting, unsuitable footwear, unsafe use of ladders.
Ergonomic hazards	
<ul style="list-style-type: none"> ▪ Heavy loads/heavy dynamic work 	Risk of pain from heavy loads and heavy dynamic work.
<ul style="list-style-type: none"> ▪ Awkward position/unbalanced strain 	Risk of pain or injury from working in awkward positions.
<ul style="list-style-type: none"> ▪ Repetitive movements 	Risk of pain or injury from performing repetitive tasks.
<ul style="list-style-type: none"> ▪ Lack of exercise; inactivity 	Risk of chronic neck and back pain, obesity and cardiovascular diseases resulting from inactivity, prolonged sitting and from poor ergonomic practices with mobile devices.
Electrical hazards	
<ul style="list-style-type: none"> ▪ Electric shock 	Risk of electrocution from poorly maintained or broken machinery and electrical cables.
Hazards due to physical effects/physical agents	
<ul style="list-style-type: none"> ▪ Noise 	Exposure to loud noise from machinery and tools.
<ul style="list-style-type: none"> ▪ Vibration 	Risk of hand-arm vibration from vibrating tools or workpieces.
<ul style="list-style-type: none"> ▪ Laser light 	Exposure to laser light from laser cutting machines.
Fire and explosion hazards	
<ul style="list-style-type: none"> ▪ Flammable substances 	<p>Explosion: Explosion risks from materials, including wood dust and chemicals.</p> <p>Fire: Risk of fire from chemicals and wood dust.</p>
Work environmental hazards	
<ul style="list-style-type: none"> ▪ Poor lighting conditions 	Risk of glare or insufficient light as well as flickering light.
<ul style="list-style-type: none"> ▪ Climate 	Risk of being exposed to hot or cold work environment combined with humidity or draughts.
<ul style="list-style-type: none"> ▪ Poor ventilation 	Risk of being exposed to a working environment with poor ventilation or fresh air.

Hazards through dangerous substances	
▪ Dust	Cancer risk from wood dust. Risk of allergic respiratory symptoms from wood dust.
▪ Solvents (neurotoxic, allergens)	Risks from chemicals, solvents and other materials – dermatitis, allergic reactions or respiratory problems, organ damage.
▪ Carcinogens	Cancer risks from chemicals (adhesives and coating agents are used in finishing wood products, such as solvents in paints, glues, varnishes and lacquers, and paint stripping chemicals.)
▪ Chemical burns	Risk of burns and other skin effects from chemicals
▪ New materials (e.g. Nanomaterials)	Risk of exposure to nanomaterials: there are large gaps in the knowledge about health hazards associated to nanomaterials.
Psychosocial hazards	
▪ Excessive workloads	Excessive workload put workers at risk of high levels of time pressure, and working at the limit.
▪ Low job satisfaction	Low job satisfaction lead to psychological distress in workers and may result in sleep disorders, headaches and gastro-intestinal problems.
▪ Work tasks not clearly defined	Poor organisation of work, tasks that are not clearly defined may put workers at risk of work overload or under load, and result in discontent and stress.
▪ Poor organisation of work	Poor organisation of work may put workers at risk of work overload or under load, machine pacing, high levels of time pressure.
▪ Poorly designed workplace environment (incl. software)	Inadequate equipment availability, suitability or maintenance; poor environmental conditions such as lack of space, poor lighting, excessive noise put workers at stress.
▪ Repetitive, monotonous work	
▪ Cognitive strain	Cognitive interactions with autonomous equipment and virtual reality put workers at stress.
▪ Stress due to long period concentration and awareness	Long period of concentration working with computer and new software and performing multitasks.
▪ Increased demands on flexibility	Increased demand on flexibility: workers may perform some tasks from everywhere with mobile devices. Workers are at risk of being permanent available outside working hours.
▪ Lack of work experience	New software and digital devices require training, some workers may not have enough competences and may feel overloaded, not experienced enough.
▪ Lack of involvement in making decisions that affect the worker	Workers that do not see themselves respected and appreciated, they feel themselves vulnerable and helpless.
▪ Ineffective communication, lack of support from management or colleagues	Ineffective communication due to bad working atmosphere or lack of colleagues put workers at stress.
▪ Working alone/isolation	Working alone without colleagues or only with robots put workers at stress and isolation.
▪ Unbalanced workload: overload/underload	Unbalanced workload put workers at stress.

A short description of skills, knowledge and competences

The definitions of the following concepts are the same in ESCO and in the European Qualifications Framework (EQF).

Knowledge

"Knowledge means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study."

Both skills and competences rely on factual and theoretical knowledge, the difference lies in the way this knowledge is applied and being put into use.

Skills

"Skill means the ability to apply knowledge and use know-how to complete tasks and solve problems". They can be described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).

Competences

"Competence means the proven ability and individual capacity to use knowledge (theoretical and practical), skills and personal, social and/or methodological abilities, in real work or study situations and in professional and personal development." They are described in terms of responsibility and autonomy. Competences are therefore by definition individual, process-oriented (action and development-oriented) and contextual.

While sometimes used as synonyms, the terms skill and competence can be distinguished according to their scope. The term skill refers typically to the use of methods or instruments in a particular setting and in relation to defined tasks. The term competence is broader and refers typically to the ability of a person – facing new situations and unforeseen challenges – to use and apply knowledge and skills in an independent and self-directed way.

Thus:

- Knowledge = theoretical, practical, occupational, industrial ...
- Skills = cognitive, practical, social ... Skills = know how to ...
- Competence = task-based, occupational, procedural, social, personal ... Competence = social and self competence

Occupational profiles: current and forecasted changes in 2025

This report section includes the details of the changes forecasted within the **wood furniture sector** due to its digitization in 2025: the **updated tasks** of the targeted occupational profiles, the

existing and new OHS risks and the **updated skills, knowledge and competencies needs**. They are presented through specific tables focusing on each of these aspects.

Tasks changes

Current and forecasted tasks changes due to sector digitization for each occupational profile.

In these **blue tables**, the first column on the left includes a detailed description for each profile of the current/updated tasks (in 2018). The columns and cells in the middle identify which tasks are affected by the different McKinsey Levers and industry

4.0 technologies. The following column forecast the temporal horizon of this impact. The following 4 columns forecast which is the probability of those changes to happen in each of the four classified groups of companies. The last column on the right presents the forecast of the updated tasks in 2025, identifying in red all the changes.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for each occupational profile.

In these **yellow tables**, the first and the last columns are the same than in previous Tasks changes tables. The central cells represent the forecast of the **new categorization of hazards**, identifying in

black the ones that should not change, in **red** the new ones and in **yellow** the ones reduced thanks to the new technologies. Following this table, another section contains the **details of current and forecasted hazards and risks**.

Skills and competences needs

Forecast of training new needs due to sector digitization for each occupational profile.

In these **green tables**, on the left column you will find the list of current and new skills, knowledge and competences needs. The second column will tell you for each profile if they will be updated (YES, changed), still needed (YES or NO) or new ones (NEW). In the

last columns on the right, which number and content differ for each profile, identify the reasons of change for each of the skills, knowledge and competences.

In all the following tables, we used the red colour text to identify any change to the current situation.

Sales and marketing managers

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

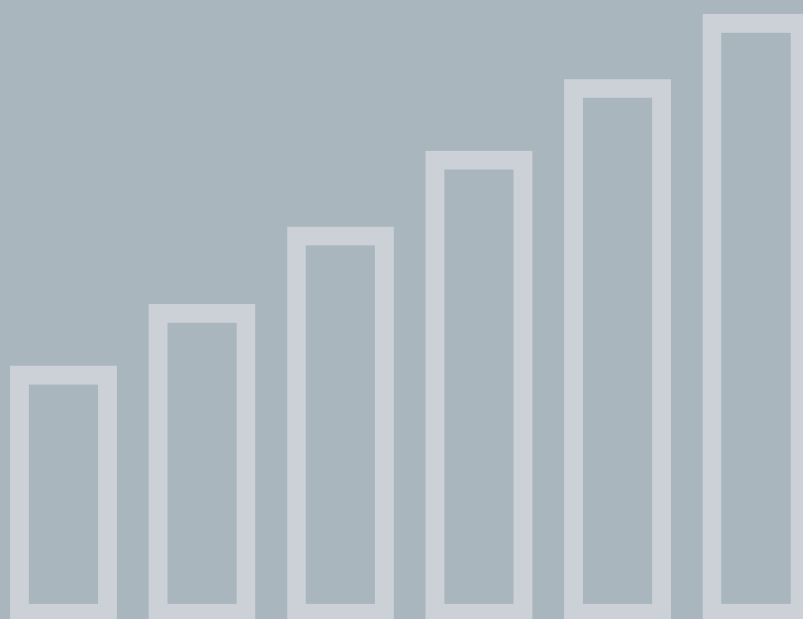
Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.



Sales and marketing managers

ISCO 1221

2018

Occupational profile

Current profile description

Sales and marketing managers plan, direct and coordinate the sales and marketing activities of an enterprise or organization, or of enterprises that provide sales and marketing services to other enterprises and organizations.

Current profile tasks

Current profile tasks	McKinsey Levers														Industry 4.0 technologies							Forecast temporal horizon for change													
	Resource process	Asset utilization			Labor	Inventories	Quality	Supply/demand match	Time to market																										
	Smart energy consumption	Real-time yield optimization	Intelligent IoTs	Routing flexibility	Machine flexibility	Remote monitoring and control	Predictive maintenance	Augmented reality for MRO	Human-robot collaboration	Remote monitoring and control	Automation of knowledge work	Digital performance management	Batch size 1	Real-time SC optimization	In situ 3D printing	Digital quality management	Statistical process control (SPC)	Advanced process control (APC)	Data-driven demand prediction	Data-driven design to value	Rapid experimentation and simulation	Customer co-creation/ open innovation	Concurrent engineering	Big data and analytics	Autonomous robots	Simulation	Horizontal and vertical system integration	The industrial internet of things	Cybersecurity	The cloud	Additive manufacturing	Augmented reality			
A Planning and organizing special sales and marketing programmes based on sales records and market assessments.			▪																																before 2025
B Determining price lists, discount and delivery terms, sales promotion budgets, sales methods, special incentives and campaigns.			▪																																before 2025
C Establishing and directing operational and administrative procedures related to sales and marketing activities.																																			before 2025
D Leading and managing the activities of sales and marketing staff.																																			before 2025
E Planning and directing daily (sales and marketing) operations.																																			before 2025
F Establishing and managing budgets and controlling expenditure to ensure the efficient use of resources.	▪	▪																																	before 2025
G Overseeing the selection, training and performance of staff.																																			before 2025
H Representing the enterprise or organization at sales and marketing conventions, trade exhibitions and other forums.																																			before 2025



2025

Occupational profile

Probability of technologies adoption in the following groups of companies				
A1	A2	B1	B2	
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)	
				Description forecast of the occupational profile in 2025 Sales and marketing managers plan, direct and coordinate the sales and marketing activities of highly digitized enterprises or organizations, or of enterprises that provide sales and marketing services to other digitized enterprises and organizations. Use digitization tools to work in a customer-oriented manner.
				Profile tasks forecast
High	High	High	Medium	A Planning and organizing special sales and marketing programmes based on connected customers ecosystem, sales records and global digitized market assessments.
High	High	Medium	Light	B Determining price lists, discount and delivery terms, sales promotion budgets, sales methods, special incentives and campaigns using digitized inputs from customer ecosystems and a globally connected distribution and marketing network.
High	High	Medium	Light	C Establishing and directing digitized operational and administrative procedures related to sales and marketing activities.
High	High	High	Medium	D Leading and managing the activities of sales and marketing staff in highly digitized organizations.
High	High	High	Medium	E Planning and directing daily (sales and marketing) operations within a highly digitized enterprise-customer ecosystem.
High	High	Medium	Light	F Establishing and managing budgets and controlling expenditure to ensure the efficient use of resources in a fully connected and digitized system.
High	High	High	High	G Overseeing the selection, training and performance of staff exploiting tools and instruments of an highly connected and digitized company.
High	High	High	High	H Representing the enterprise or organization at sales and marketing conventions, trade exhibitions, in online platforms and other face-to-face or virtual forums.

Sales and marketing managers

ISCO 1221

2018

Occupational profile

Current profile description

Sales and marketing managers plan, direct and coordinate the sales and marketing activities of an enterprise or organization, or of enterprises that provide sales and marketing services to other enterprises and organizations.

Current profile tasks

A	Planning and organizing special sales and marketing programmes based on sales records and market assessments.
B	Determining price lists, discount and delivery terms, sales promotion budgets, sales methods, special incentives and campaigns.
C	Establishing and directing operational and administrative procedures related to sales and marketing activities.
D	Leading and managing the activities of sales and marketing staff.
E	Planning and directing daily (sales and marketing) operations.
F	Establishing and managing budgets and controlling expenditure to ensure the efficient use of resources.
G	Overseeing the selection, training and performance of staff.
H	Representing the enterprise or organization at sales and marketing conventions, trade exhibitions and other forums.

New categorization of hazards

	Mechanical hazards	Unprotected moving parts ¹	Parts with hazardous shapes (cutting, pointed, rough)	Moving means of transport and tools ²	Uncontrolled moving parts (flying objects, wood chips)	Slip and trips	Falls from height	Ergonomic hazards	Heavy loads/heavy dynamic work	Awkward position/unbalanced strain	Repetitive movements	Lack of exercise, inactivity	Electrical hazards	Electric shock	Hazards due to physical effects/physical agents	Noise	Vibration	Laser/light	Fire and explosion hazards	Flammable substances	Work environment hazards	Poor lighting conditions	Climate	Poor ventilation	Hazards through dangerous substances	Dust	Solvents (neurotoxic, allergens)	Carcinogens	New materials (e.g. Nanomaterials)	Psychosocial hazards	Excessive workloads
A												■										■	■							■	
B												■										■	■							■	
C												■										■	■							■	
D												■										■	■							■	
E												■										■	■							■	
F												■										■	■							■	
G												■										■	■							■	
H						■						■										■	■							■	

■ No changes ■ New ones ■ Reduced

¹ Cobotics (Squeezing, bumping, crushing, cutting, amputation, drawing-in/trapping).
² Run over, roll over, falls from height.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile Sales and marketing managers - ISCO 1221

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work system/work area Office work, business trips, visits to trade fairs, contact with business partners and clients.</p>	<p>Work system/work area Office work, business trips, visits to trade fairs, contact with business partners and clients. Use of innovative software and tools.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> ▪ Slips and trips, obstacles, table edges, moving vehicles, machines. <p>Effects: squeezing, cutting, twisting, spraining, bumps and bruises.</p>	<ul style="list-style-type: none"> ▪ Slips and trips, obstacles, table edges, moving vehicles, machines <p>Effects: squeezing, cutting, twisting, spraining, bumps and bruises.</p>
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions and inactivity. <p>Effects: musculoskeletal diseases, overweight, cardiovascular problems.</p>	<ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions and inactivity. Digitization will put workers more at risk of being exposed to ergonomic hazards such as lack of exercise/inactivity because of operating autonomous equipment from their office, participating in virtual conferences and online platforms. <p>Effects: musculoskeletal diseases, overweight, cardiovascular problems.</p>
<p>Electrical hazards</p> <ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices). <p>Effect: fatal accident.</p>	<ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices). <p>Effect: fatal accident.</p>
<p>Work environmental hazards</p> <ul style="list-style-type: none"> ▪ Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. <p>Effect: eyestrain, headache, colds, cardiovascular problems.</p>	<ul style="list-style-type: none"> ▪ Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. <p>Effect: eyestrain, headache, colds, cardiovascular problems.</p>
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> ▪ Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information. ▪ Social relationship: difficult clients, difficult colleagues. ▪ Working method: Frequent contacts with customers, cooperation with other departments. Use of simple software and CRM. <p>Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.</p>	<ul style="list-style-type: none"> ▪ Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information, increased demand on flexibility. ▪ Social relationship: difficult clients, difficult colleagues, lack of social contacts. ▪ Working method: Frequent contacts with customers, growing cooperation with other departments. Use of innovative software, digital equipment, cognitive interactions with autonomous machines and virtual reality, virtual conferences. Long period of concentration to work with computer and new software and performing multitasking. Increased demand on flexibility as workers/managers may work from everywhere with mobile devices. Managers/workers are also at risk of being permanent available outside working hours, this will increase with digitalization. <p>Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders, cognitive strain, stress due to long period of concentration.</p>

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile Sales and marketing managers - ESCO 1221

		Will it continue to be needed?	Main reasons of change			
			Use digitization tools to work in a customer-oriented manner	Using digitized input from customer ecosystems and a globally connected distribution and marketing network	Working within a highly digitized enterprise-customer ecosystem	Working in a fully connected and digitized system
Essential skills and competences	Align efforts towards business development	YES, changed		■	■	■
	Build business relationships	YES, changed	■	■	■	
	Develop professional network	YES, changed		■		■
	Implement marketing strategies	YES, changed	■	■	■	■
	Integrate new products in manufacturing	YES, changed		■	■	
	Manage contracts	YES				
	Manage sales channels	YES, changed		■		■
	Manage sales teams	YES				
	Use analytics for commercial purposes	YES, changed	■	■		■
Essential knowledge	Commercial law	YES				
	Customer relationship management	YES, changed	■	■	■	
	Product comprehension	YES				
	Project management	YES				
	Risk management	YES, changed		■		■
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	■	■		■
	Collaboration Across Networks and Leading by Influence	NEW	■	■	■	
	Agility and Adaptability	NEW	■	■	■	■
	Initiative and Entrepreneurship	NEW		■		
	Effective Oral and Written Communication	NEW	■	■		
	Assessing and Analyzing Information	NEW	■	■	■	■
	Curiosity and Imagination	NEW			■	
	Digital literacy	NEW	■	■	■	■
	Data security	NEW	■	■	■	■

Industrial production manager

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.



Industrial Production manager

ISCO 13215

2018 ▶▶

Occupational profile

Current profile description

Industrial production managers oversee the operations and the resources needed in industrial plants and manufacturing sites for a smooth running of the operations. They prepare the production schedule by combining the requirements of clients with the resources of the production plant. They organise the journey of incoming raw materials or semi finished products in the plant until a final product is delivered by coordinating inventories, warehouses, distribution, and support activities.



McKinsey Levers							Industry 4.0 technologies										Forecast temporal horizon for change															
Resource process	Asset utilization		Labor		Inventories	Quality	Supply/demand match	Time to market																								
Smart energy consumption	Real-time yield optimization	Intelligent Lots	Routing flexibility	Machine flexibility	Remote monitoring and control	Predictive maintenance	Augmented reality for MRO	Human-robot collaboration	Remote monitoring and control	Automation of knowledge work	Digital performance management	Batch size 1	Real-time SC optimization	In-situ 3D printing	Digital quality management	Statistical process control (SPC)	Advanced process control (APC)	Data-driven demand prediction	Data-driven design to value	Rapid experimentation and simulation	Customer co-creation/ open innovation	Concurrent engineering	Big data and analytics	Autonomous robots	Simulation	Horizontal and vertical system integration	The industrial internet of things	Cybersecurity	The cloud	Additive manufacturing	Augmented reality	

Current profile tasks

Task	Smart energy consumption	Real-time yield optimization	Intelligent Lots	Routing flexibility	Machine flexibility	Remote monitoring and control	Predictive maintenance	Augmented reality for MRO	Human-robot collaboration	Remote monitoring and control	Automation of knowledge work	Digital performance management	Batch size 1	Real-time SC optimization	In-situ 3D printing	Digital quality management	Statistical process control (SPC)	Advanced process control (APC)	Data-driven demand prediction	Data-driven design to value	Rapid experimentation and simulation	Customer co-creation/ open innovation	Concurrent engineering	Big data and analytics	Autonomous robots	Simulation	Horizontal and vertical system integration	The industrial internet of things	Cybersecurity	The cloud	Additive manufacturing	Augmented reality	Forecast	
A Determining, implementing and monitoring production strategies, policies and plans.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
B Planning details of production activities in terms of output quality and quantity, cost, time available and labour requirements.				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
C Controlling the operation of production plant and quality procedures through planning of maintenance, designation of operating hours and supply of parts and tools.	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
D Establishing and managing budgets, monitoring production output and costs, and adjusting processes and resources to minimize costs.	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
E Consulting with and informing other managers about production matters.		•	•	•			•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
F Overseeing the acquisition and installation of new plant and equipment.	•	•	•	•					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
G Controlling the preparation of production records and reports.			•													•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
H Coordinating the implementation of occupational health and safety requirements.																	•																before 2025	
I Identifying business opportunities and determining products to be manufactured.		•				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2025
J Researching and implementing regulatory and statutory requirements affecting manufacturing operations and the environment.									•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
K Overseeing the provision of quotations for the manufacture of specialized goods and establishing contracts with customers and suppliers.																•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
L Overseeing the selection, training and performance of staff.	•					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025



2025

Occupational profile

Probability of technologies adoption in the following groups of companies				
A1	A2	B1	B2	
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)	
High	High	High	Medium	
High	High	High	Medium	
High	High	Medium	Light	
High	High	Medium	Light	
High	High	High	Medium	
High	High	High	Medium	
High	High	Medium	Light	
High	High	High	High	
High	Medium	Medium	Light	
High	High	High	High	
High	High	High	High	
High	High	High	High	

Description forecast of the occupational profile in 2025

Industrial production managers oversee the operations and the resources needed in **highly digitised** industrial plants and manufacturing sites for a smooth running of the operations. **Supported by data and instruments of highly digitized systems**, they prepare the production schedule by combining the requirements of clients with the resources of the production plant. They organise the journey of incoming raw materials or semi finished products in the plant until a final product is delivered by coordinating inventories, warehouses, distribution, and support activities. **Use digitization tools to work in a customer-oriented manner.**

Profile tasks forecast

- A Determining, implementing and monitoring production strategies, policies and plans **exploiting the possibilities of a highly digitised manufacturing plant.**
- B Planning details of a **highly digitized and connected set** of production activities in terms of output quality and quantity, cost, time available and labour requirements.
- C Controlling the operation of a **highly digitised** production plant including handling of quality procedures through planning of maintenance, designation of operating hours and supply of parts and tools.
- D Establishing and managing budgets, monitoring production output and costs, and adjusting processes and resources to minimize costs **in a highly connected digital manufacturing chain.**
- E **Securing distribution of information** of all production matters to other managers **as part of digital performance management** as well as consultations with other managers in general.
- F Overseeing the acquisition and installation of **highly digitised** new plants and equipment.
- G Securing the preparation of **fully integrated and digitised** production records and reports.
- H Coordinating the implementation of occupational health and safety requirements **as part of the highly integrated digital enterprise ecosystem.**
- I Identifying business opportunities and determining **smart (digital)** products to be manufactured in **an extremely digitised** manufacturing ecosystem.
- J Researching and implementing regulatory and statutory requirements affecting **highly digitised** manufacturing operations, the environment **and the general company ecosystem.**
- K **Exploiting data and instruments of a highly digitized system**, overseeing the provision of quotations for **the digitized** manufacture of specialized goods and establishing contracts with customers and suppliers.
- L Overseeing the selection, training and performance of staff **exploiting tools and instruments of an highly connected and digitized company.**

Industrial Production manager

ISCO 13215

2018 ▶▶

Occupational profile

Current profile description

Industrial production managers oversee the operations and the resources needed in industrial plants and manufacturing sites for a smooth running of the operations. They prepare the production schedule by combining the requirements of clients with the resources of the production plant. They organise the journey of incoming raw materials or semi finished products in the plant until a final product is delivered by coordinating inventories, warehouses, distribution, and support activities.

Current profile tasks

Task	New categorization of hazards																														
	Mechanical hazards	Unprotected moving parts ¹	Parts with hazardous shapes (cutting, pointed, rough)	Moving means of transport and tools ²	Uncontrolled moving parts (flying objects, wood chips)	Slip and trips	Falls from height	Ergonomic hazards	Heavy loads/heavy dynamic work	Awkward position/unbalanced strain	Repetitive movements	Lack of exercise, inactivity	Electrical hazards	Electric shock	Hazards due to physical effects/physical agents	Noise	Vibration	Laser/light	Fire and explosion hazards	Flammable substances	Work environment hazards	Poor lighting conditions	Climate	Poor ventilation	Hazards through dangerous substances	Dust	Solvents (neurotoxic, allergens)	Carcinogens	New materials (e.g. Nanomaterials)	Psychosocial hazards	Excessive workloads
A Determining, implementing and monitoring production strategies, policies and plans.												■										■	■								■
B Planning details of production activities in terms of output quality and quantity, cost, time available and labour requirements.												■										■	■								■
C Controlling the operation of production plant and quality procedures through planning of maintenance, designation of operating hours and supply of parts and tools.												■										■	■								■
D Establishing and managing budgets, monitoring production output and costs, and adjusting processes and resources to minimize costs: processes and resources to minimize costs.												■										■	■								■
E Consulting with and informing other managers about production matters.												■										■	■								■
F Overseeing the acquisition and installation of new plant and equipment.												■										■	■								■
G Controlling the preparation of production records and reports.												■										■	■								■
H Coordinating the implementation of occupational health and safety requirements.												■										■	■								■
I Identifying business opportunities and determining products to be manufactured.												■										■	■								■
J Researching and implementing regulatory and statutory requirements affecting manufacturing operations and the environment.												■										■	■								■
K Overseeing the provision of quotations for the manufacture of specialized goods and establishing contracts with customers and suppliers.												■										■	■								■
L Overseeing the selection, training and performance of staff.												■										■	■								■

■ No changes ■ New ones ■ Reduced

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile Industrial production manager - ISCO 1321s

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work system/work area Office work, use of software, inspection of production facilities and machines, contact with clients.</p>	<p>Work system/work area Office work, use of software, inspection of production facilities and machines, contact with clients, use of digitalized equipment and systems.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> Slips and trips, obstacles, table edge, Safety hazards/accidents due to unknown workplaces, travelling and setting up stands. <p>Effects: squeezing, cutting, twisting, spraining, bumps and bruises.</p>	<ul style="list-style-type: none"> Slips and trips, obstacles, table edge, Safety hazards/accidents due to unknown workplaces, travelling and setting up stands. <p>Effects: squeezing, cutting, twisting, spraining, bumps and bruises.</p>
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> Ergonomic hazards: from poor ergonomic conditions and inactivity. <p>Effects: musculoskeletal diseases, overweight, cardiovascular problems.</p>	<ul style="list-style-type: none"> Ergonomic hazards: from poor ergonomic conditions and inactivity. Digitization put workers at risk of being exposed to ergonomic hazards such as lack of exercise/inactivity because of operating autonomous machines from their office, participating in virtual conferences and online platforms. <p>Effects: musculoskeletal diseases, overweight, cardiovascular problems.</p>
<p>Electrical hazards</p> <ul style="list-style-type: none"> Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices). <p>Effect: fatal accident.</p>	<ul style="list-style-type: none"> Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices). <p>Effect: fatal accident.</p>
<p>Work environmental hazards</p> <ul style="list-style-type: none"> Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. <p>Effect: eyestrain, headache, colds, cardiovascular problems.</p>	<ul style="list-style-type: none"> Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. <p>Effect: eyestrain, headache, colds, cardiovascular problems.</p>
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information, increased demand on flexibility. Social relationship: difficult clients, difficult colleagues. Working method: Digital equipment, software. Long period of concentration working with computer and new software and performing multitasking. Managers/workers are also at risk of being permanent available outside working hours. <p>Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.</p>	<ul style="list-style-type: none"> Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information, increased demand on flexibility. Social relationship: difficult clients, difficult colleagues, lack of social contacts. Working method: digital equipment, cognitive interactions between autonomous techniques and virtual reality, virtual conferences. Digital equipment, cognitive interactions with autonomous machines and virtual reality, virtual conferences. Long period of concentration working with computer and new software and performing multitasking. Increased demand on flexibility as workers/managers may work from everywhere with mobile devices. Managers/workers are also at risk of being permanent available outside working hours. <p>Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders, cognitive strain, stress due to long period of concentration.</p>

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile Industrial production manager - ESCO 1321s

		Will it continue to be needed?	Main reasons of change				
			Support by data and instruments of highly digitized systems	Use digitization tools to work in a customer-oriented manner	Exploiting the possibilities, tools and instruments of a highly connected and digitized manufacturing plant/chain	Securing distribution of information	Working in a fully connected and digitized system
Essential skills and competences	Adhere to organisational guidelines	YES					
	Adjust production schedule	YES, changed	▪	▪	▪		
	Assess impact of industrial activities	YES, changed	▪	▪	▪		
	Check material resources	YES, changed	▪	▪	▪		
	Control financial resources	YES					
	Create manufacturing guidelines	YES, changed	▪	▪	▪	▪	
	Define quality standards	YES, changed	▪		▪	▪	
	Liaise with industrial professionals	YES, changed	▪	▪	▪	▪	▪
	Manage budgets	YES					
	Manage resources	YES, changed	▪		▪		
	Manage staff	YES, changed	▪		▪		
	Manage supplies	YES, changed	▪	▪	▪		
	Meet deadlines	YES					
	Oversee assembly operations	YES, changed	▪	▪	▪		
	Oversee production requirements	YES, changed	▪	▪	▪		
	Plan health and safety procedures	YES					
Essential knowledge	Industrial health and safety measures	YES					
	Industrial engineering	YES, changed	▪	▪	▪	▪	▪
	Manufacturing processes	YES, changed	▪	▪	▪	▪	▪
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	▪	▪	▪	▪	▪
	Collaboration Across Networks and Leading by Influence	NEW	▪	▪	▪		
	Agility and Adaptability	NEW	▪	▪	▪	▪	▪
	Initiative and Entrepreneurship	NEW			▪	▪	
	Effective Oral and Written Communication	NEW			▪	▪	
	Assessing and Analyzing Information	NEW	▪	▪	▪	▪	▪
	Curiosity and Imagination	NEW			▪	▪	
	Digital literacy	NEW	▪	▪	▪	▪	▪
Data security	NEW	▪	▪	▪	▪	▪	

Supply chain manager

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.





2025

Occupational profile

Probability of technologies adoption in the following groups of companies					Description forecast of the occupational profile in 2025 Supply chain managers plan, manage and coordinate all activities related to the sourcing and procurement of supplies needed to run manufacturing operations from the acquisition of raw materials to the distribution of finished products with the support of updated and continuous data collected in an highly connected and digitized company system. The supplies can be raw materials or finished products, and it can be for internal or external use. Moreover, they plan and commission all the activities needed to be performed in manufacturing plants and adjust operations to changing levels of demand for a company's products. Use digitization tools to work in a customer-oriented manner.
A1	A2	B1	B2		
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)		
				Profile tasks forecast A Determining, implementing and monitoring purchasing, storage and distribution strategies, policies and plans of the digitised ecosystem.	
				B Preparing and implementing plans to maintain required stock levels of the highly digitised enterprise ecosystem at minimum cost.	
				C Negotiating contracts with suppliers to meet quality, cost and delivery requirements of the highly digitised enterprise ecosystem.	
				D Monitoring and reviewing storage and inventory systems to meet supply requirements, and control stock levels through the data and instruments of an highly interconnected and digitised enterprise ecosystem.	
				E Overseeing the dispatch of road vehicles, trains, vessels or aircraft through digitised updated and continuous data collected in an highly connected and digitized enterprise ecosystem.	
				F Operating recording systems to track all movements of goods, and ensuring reordering and restocking at optimal times of the highly digitised enterprise ecosystem.	
				G Liaising with other departments and customers concerning requirements for outward goods and associated forwarding transportation using the highly digitised ecosystem inside and outside the company.	
				H Overseeing the recording of purchase, storage and distribution transactions as an integrated part of the digitised work process of the digital factory ecosystem.	
				I Establishing and managing budgets, controlling expenditure and ensuring the efficient use of resources as integrated part of the highly interconnected and digitised company ecosystem.	
				J Establishing and directing operational and administrative procedures in the highly digitised company ecosystem.	
				K Planning and directing daily operations both physically and digitally using the connected cloud.	
				L Overseeing the selection, training and performance of staff exploiting tools and instruments of a highly connected and digitized company.	

Supply Chain manager

ISCO 1324s

2018 ▶▶

Occupational profile

Current profile description

Supply chain managers plan, manage and coordinate all activities related to the sourcing and procurement of supplies needed to run manufacturing operations from the acquisition of raw materials to the distribution of finished products. The supplies can be raw materials or finished products, and it can be for internal or external use. Moreover, they plan and commission all the activities needed to be performed in manufacturing plants and adjust operations to changing levels of demand for a company's products.

Current profile tasks

A	Determining, implementing and monitoring purchasing, storage and distribution strategies, policies and plans.
B	Preparing and implementing plans to maintain required stock levels at minimum cost.
C	Negotiating contracts with suppliers to meet quality, cost and delivery requirements.
D	Monitoring and reviewing storage and inventory systems to meet supply requirements, and control stock levels.
E	Overseeing the dispatch of road vehicles, trains, vessels or aircraft.
F	Operating recording systems to track all movements of goods, and ensuring reordering and restocking at optimal times.
G	Liaising with other departments and customers concerning requirements for outward goods and associated forwarding transportation.
H	Overseeing the recording of purchase, storage and distribution transactions.
I	Establishing and managing budgets, controlling expenditure and ensuring the efficient use of resources.
J	Establishing and directing operational and administrative procedures.
K	Planning and directing daily operations.
L	Overseeing the selection, training and performance of staff.



New categorization of hazards

	Mechanical hazards	Unprotected moving parts ¹	Parts with hazardous shapes (cutting, pointed, rough)	Moving means of transport and tools ²	Uncontrolled moving parts (flying objects, wood chips)	Slip and trips	Falls from height	Ergonomic hazards	Heavy loads/heavy dynamic work	Awkward position/unbalanced strain	Repetitive movements	Lack of exercise, inactivity	Electrical hazards	Electric shock	Hazards due to physical effects/physical agents	Noise	Vibration	Laser/light	Fire and explosion hazards	Flammable substances	Work environment hazards	Poor lighting conditions	Climate	Poor ventilation	Hazards through dangerous substances	Dust	Solvents (neurotoxic, allergens)	Carcinogens	New materials (e.g. Nanomaterials)	Psychosocial hazards	Excessive workloads
A												■										■	■							■	
B												■										■	■							■	
C												■										■	■							■	
D												■										■	■							■	
E												■										■	■							■	
F												■										■	■							■	
G												■										■	■							■	
H												■										■	■							■	
I												■										■	■							■	
J												■										■	■							■	
K												■										■	■							■	
L												■										■	■							■	

■ No changes ■ New ones ■ Reduced

¹ Cobotics (Squeezing, bumping, crushing, cutting, amputation, drawing-in/trapping).
² Run over, roll over, falls from height.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile Supply Chain manager - ISCO 1324s

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work system/work area Office work, business trips, contact with clients and business partners, use of complex software.</p>	<p>Work system/work area Office work, business trips, contact with clients and business partners, use of complex software, use of digitalized tools.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> ▪ Slips and trips, obstacles, table edges. <p>Effects: squeezing, cutting, twisting, spraining, bumps and bruises.</p>	<ul style="list-style-type: none"> ▪ Slips and trips, obstacles, table edge. <p>Effects: squeezing, cutting, twisting, spraining, bumps and bruises.</p>
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions and inactivity. <p>Effects: musculoskeletal diseases, overweight, cardiovascular problems.</p>	<ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions and inactivity. Digitization put workers at risk of being exposed to ergonomic hazards such as lack of exercise/inactivity because of operating autonomous equipment from their office, participating in virtual conferences and online platforms. <p>Effects: musculoskeletal diseases, overweight, cardiovascular problems.</p>
<p>Electrical hazards</p> <ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices). <p>Effect: fatal accident.</p>	<ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices). <p>Effect: fatal accident.</p>
<p>Work environmental hazards</p> <ul style="list-style-type: none"> ▪ Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. <p>Effect: eyestrain, headache, colds, cardiovascular problems.</p>	<ul style="list-style-type: none"> ▪ Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. <p>Effect: eyestrain, headache, colds, cardiovascular problems.</p>
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> ▪ Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information. ▪ Social relationship: difficult clients, difficult colleagues. ▪ Working method: Digital equipment, software. Long period of concentration working with computer and new software and performing multitasking. Managers/workers are also at risk of being permanent available outside working hours. <p>Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.</p>	<ul style="list-style-type: none"> ▪ Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information, increased demand on flexibility. ▪ Social relationship: difficult clients, lack of social contacts. ▪ Working method: digital equipment, cognitive interactions with autonomous technologies and virtual reality, virtual conferences. Digitization may put workers more at risk of long period of concentration working with computer and new software and performing multitasking. Increased demand on flexibility as workers/managers may work from everywhere with mobile devices. Managers/workers are also at risk of being permanent available outside working hours. <p>Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders, cognitive strain, stress due to long period of concentration.</p>

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile Supply chain manager – ESCO 1324s

		Will it continue to be needed?	Main reasons of change				
			Using the updated and continuous data and instruments, collected in an highly connected and digitized company systems	Use digitization tools to work in a customer-oriented manner	Working in a highly digitized enterprise ecosystem	Using the highly digitized ecosystem inside and outside the company	Using resources as an integrated part of the highly interconnected and digitized company ecosystem
Essential skills and competences	Analyse logistic changes	YES, changed	■	■		■	■
	Analyse supply chain strategies	YES, changed	■	■		■	■
	Analyse supply chain trends	YES, changed		■		■	
	Assess supplier risks	YES, changed	■			■	
	Estimate costs of required supplies	YES, changed	■				■
	Follow company standards	YES, changed	■	■			
	Liaise with managers	YES, changed				■	■
	Maintain relationship with customers	YES, changed		■		■	
	Maintain relationship with suppliers	YES, changed		■		■	
	Manage inventory	NO					
	Manage supplies	YES, changed	■	■		■	■
	Order supplies	NO					
	Strive for company growth	YES, changed	■	■		■	■
Essential knowledge	Corporate social responsibility	YES					
	Supplier management	YES, changed	■	■			
	Supply chain management	YES, changed				■	■
	Supply chain principles	YES					
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	■	■	■	■	■
	Collaboration Across Networks and Leading by Influence	NEW		■	■	■	■
	Agility and Adaptability	NEW	■	■	■	■	■
	Initiative and Entrepreneurship	NEW				■	■
	Effective Oral - Written Communication	NEW		■		■	■
	Assessing and Analyzing Information	NEW	■	■	■	■	
	Curiosity and Imagination	NEW				■	■
	Digital literacy	NEW	■	■	■	■	
	Data security	NEW	■	■	■	■	■

Maintenance & repair engineer

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.





2025

Occupational profile

Probability of technologies adoption in the following groups of companies					Description forecast of the occupational profile in 2025 Maintenance and repair engineers focus on the optimization of equipment, procedures, machineries and infrastructure in a highly integrated digital ecosystem of the digital manufacturing plant. They ensure their maximum availability at minimum costs: <ul style="list-style-type: none"> Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use. Use digitization tools to work in a customer-oriented manner. Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence. Contributes to continuous improvement of work processes in the company. Coordinates work with the rest of the team, report to his/her team leader. Cooperates with other departments (administrative, commercial, technical and ICT services). Assists in the implementation of quality assurance activities.
A1	A2	B1	B2	Profile tasks forecast	
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)		
High	High	High	Light	A Establishing standards and policies for installation, modification, quality control, testing, inspection and maintenance according to engineering principles and safety regulations in a highly digitised manufacturing plant ecosystem.	
High	High	Medium	Light	B Monitoring, inspection and digital registration of the plant to improve and maintain performance.	
High	High	Medium	Light	C Directing the digital handling of the maintenance of plant buildings and equipment, and coordinating the requirements for new designs, surveys and maintenance schedules. Preventive maintenance: <ul style="list-style-type: none"> Checks the operation of the machines, instruments (for measuring pressure, flow, temperature...) and the critical wear points, lubrication points, ... Maintains the machine or installation preventively. Predictive maintenance. Analyses the working condition of installation or machines, to predict faults on the basis of indications (via measurements and data collection). Formulates recommendations for possible interventions. Corrective maintenance. Locates and diagnoses a defect or malfunction. Replaces, repairs and tests the defective parts and adjusts them. Performs preparatory tests before releasing the machine or installation. Adaptive maintenance: modifications, changes. Provides technical support to other departments (production, quality, ICT...). Plans, develops, executes approved modifications to the installation(s). 	
High	High	High	Light	D Advising management on new smarter production methods, digital techniques and equipment.	
High	High	High	Light	E Liaising with materials purchasing, storing and controlling departments to ensure a steady flow of supplies within and around the entire digital ecosystem.	

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work system/work area Working on a wide variety of machines and workplaces, use of complex test devices and software. Working in the maintenance sector often means working during stop, start-up, shut-down, or disrupted operating phases, giving rise to potential risks in terms of accidents or exposure to many hazards. The work often requires maintenance workers to remove or dismantle collective protective equipment; as such equipment is not effective for their type of work. Maintenance workers have more serious and more frequent accidents than production workers. More so than for any other activity, maintenance-related accidents are characterised by their many different causes.</p>	<p>Work system/work area Working on a wide variety of machines and workplaces, use of complex test devices and software, use of digitalized instruments. Working in the maintenance sector often means working during stop, start-up, shut-down, or disrupted operating phases, giving rise to potential risks in terms of accidents or exposure to many hazards. The work often requires maintenance workers to remove or dismantle collective protective equipment; as such equipment is not effective for their type of work. Maintenance workers have more serious and more frequent accidents than production workers. More so than for any other activity, maintenance-related accidents are characterised by their many different causes.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> ▪ Mechanical hazards from moving machines and tools. Effects: severe bruises, amputations, cuts and sharp injuries, crushing. ▪ Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises. 	<ul style="list-style-type: none"> ▪ Mechanical hazards from moving machines and tools and from moving cobots and robots. Effects: severe bruises, amputations, cuts and sharp injuries, crushing. Risks from mechanical hazards may decrease, depending on takeover of specific task by cobots/robots. ▪ Slips and trips, obstacles, table edge. Effects: squeezing, cutting, twisting, spraining, bumps and bruises.
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions, awkward position, confined spaces, heavy physical workload. Effects: musculoskeletal diseases. 	<ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions, awkward position, confined spaces, heavy physical workload. In spite of this, risks from ergonomic hazards may decrease, depending on takeover of specific task by cobots/robots. On the other hand, workers are increasingly exposed to ergonomic hazards such as lack of exercise/inactivity because of operating autonomous machines and cobots from computer workstations. Effects: musculoskeletal diseases, overweight, cardiovascular problems.
<p>Electrical hazards</p> <ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Effect: fatal accident. 	<ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices). Effect: fatal accident.
<p>Hazards due to physical effects/physical agents</p> <ul style="list-style-type: none"> ▪ Noise Effects: hearing loss, headache, nervousness, poor concentration. ▪ Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease). ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Effect: fatal accident. 	<ul style="list-style-type: none"> ▪ Noise Effects: hearing loss, headache, nervousness, poor concentration. ▪ Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease). ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Effect: fatal accident. <p>Exposure to noise and vibration risks may decrease, depending on takeover of specific task by cobots/robots.</p>

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile Maintenance & repair engineer - ISCO 2141s

2018 Current situation	2025 Situation forecast
<p>Fire and explosion hazards</p> <ul style="list-style-type: none"> Explosion and fire hazards from materials, including wood dust, solvents and chemicals. Effects: burns, fatal accidents. 	<ul style="list-style-type: none"> Explosion and fire hazards from materials, including wood dust, solvents and chemicals. Effects: burns, fatal accidents. Risks from explosion and fire may decrease, depending on takeover of specific task by cobots/robots.
<p>Work environmental hazards</p> <ul style="list-style-type: none"> Work environmental hazards: excessive heat and cold, poor lighting. Effects: cardiovascular diseases, negative effects on muscles, tendons and joints, cold, eye strain, poor concentration. 	<ul style="list-style-type: none"> Work environmental hazards: excessive heat and cold, poor lighting. Effects: cardiovascular diseases, negative effects on muscles, tendons and joints, cold, eye strain, poor concentration.
<p>Hazards through dangerous substances</p> <ul style="list-style-type: none"> Chemical hazards/dust: asbestos, glass fibre, vapours, fumes, dust, solvents. Effects: contamination/intoxication, skin diseases, respiratory diseases, cancer. Glues and solvents for assembling parts and finishing products. Injury of the eyes caused by splashing glue, cleaners, etc., burns caused by contact with hot glue/glue guns, allergies due to contact with formaldehyde and allergenic substances, exposure to dust. Biological hazards: bacteria, mould and fungi (e.g. lubricants may contain biological hazards). Effects: contamination/intoxication, skin diseases, respiratory diseases, infections. 	<ul style="list-style-type: none"> Chemical hazards/dust: asbestos, glass fibre, vapours, fumes, dust, solvents. Effects: contamination/intoxication, skin diseases, respiratory diseases, cancer. Glues and solvents for assembling parts and finishing products. Injury of the eyes caused by splashing glue, cleaners, etc., burns caused by contact with hot glue/glue guns, allergies due to contact with formaldehyde and allergenic substances, exposure to dust. Risks may decrease with use of cobots/robots. New materials (e.g. nanomaterials): Nanotechnology and nanomaterials may be used in woods as well as wood-composite materials in order to improve some of their properties, e.g. to improve the water resistance or thermal conductivity. Effects: not yet well known, included are among others inflammation and tissue damage, fibrosis and tumour generation. Biological hazards: bacteria, mould and fungi (e.g. lubricants may contain biological hazards). Effects: contamination/intoxication, skin diseases, respiratory diseases, infections. Risks may decrease with use of cobots/robots.
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> Organisation of work: time pressure, shift work, stress, often related to poor work organisation and lack of training. Social relationship: difficult discussion with the management, difficult partners, lack of information. Working method: teamwork, working outside of "core working hours". Effects: stress, burnout. 	<ul style="list-style-type: none"> Organisation of work: time pressure, shift work, stress, often related to poor work organisation lack of training and increased demand on flexibility and digital know how. Social relationship: difficult discussion with the management, difficult partners, lack of information, lack of social contacts. Working method: working outside of "core working hours", digital equipment, cognitive interactions between autonomous techniques. The use of cobots and other digital techniques may increase the risk of working alone and feeling isolated. Cognitive interactions between a robot and a human worker can lead to mental stress. Long period of concentration working with computer and new software and performing multitasking, increased demand on flexibility as workers may work from everywhere with mobile devices. Workers are also at risk of being permanent available outside working hours. Effects: stress, burnout.

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile Maintenance and repair engineer – ESCO 2141s

		Will it continue to be needed?	Main reasons of change					
			Working in a highly integrated digital ecosystem of the digital manufacturing plant	Use digitization tools to work in a customer-oriented manner	Monitoring and inspection using big data	Digital handling and registration	Using new smarter production methods, digital techniques and equipment	
Essential skills and competences	Advise on efficiency improvements	YES, changed		■	■		■	
	Conduct quality control analysis	YES, changed		■	■			
	Conduct routine machinery checks	NO						
	Create solutions to problems	YES, changed		■			■	
	Inspect industrial equipment	NO						
	Inspect machinery	NO						
	Maintain equipment	YES, changed		■	■		■	
	Maintain machinery	YES, changed		■	■		■	
	Manage budgets	YES, changed		■	■	■		
	Perform machine maintenance	YES, changed			■		■	
	Perform test run	YES, changed			■		■	
	Resolve equipment malfunctions	YES, changed			■		■	
	Troubleshoot	YES, changed			■		■	
	Use testing equipment	YES, changed			■		■	
	Work safely with machines	YES, changed	■				■	
	Write technical reports	YES, changed			■	■		
	Essential knowledge	Engineering principles	YES					
		Engineering processes	YES					
Maintenance and repair Mechanics		YES, changed		■	■		■	
Quality assurance procedures		YES, changed	■	■	■	■		
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	■	■			■	
	Collaboration Across Networks and Leading by Influence	NEW		■			■	
	Agility and Adaptability	NEW	■	■			■	
	Initiative and Entrepreneurship	NEW					■	
	Effective Oral and Written Communication	NEW			■	■	■	
	Assessing and Analyzing Information	NEW	■	■	■	■	■	
	Curiosity and Imagination	NEW					■	
	Digital literacy	NEW	■	■	■	■	■	
	Data security	NEW	■	■	■		■	

Furniture designers

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

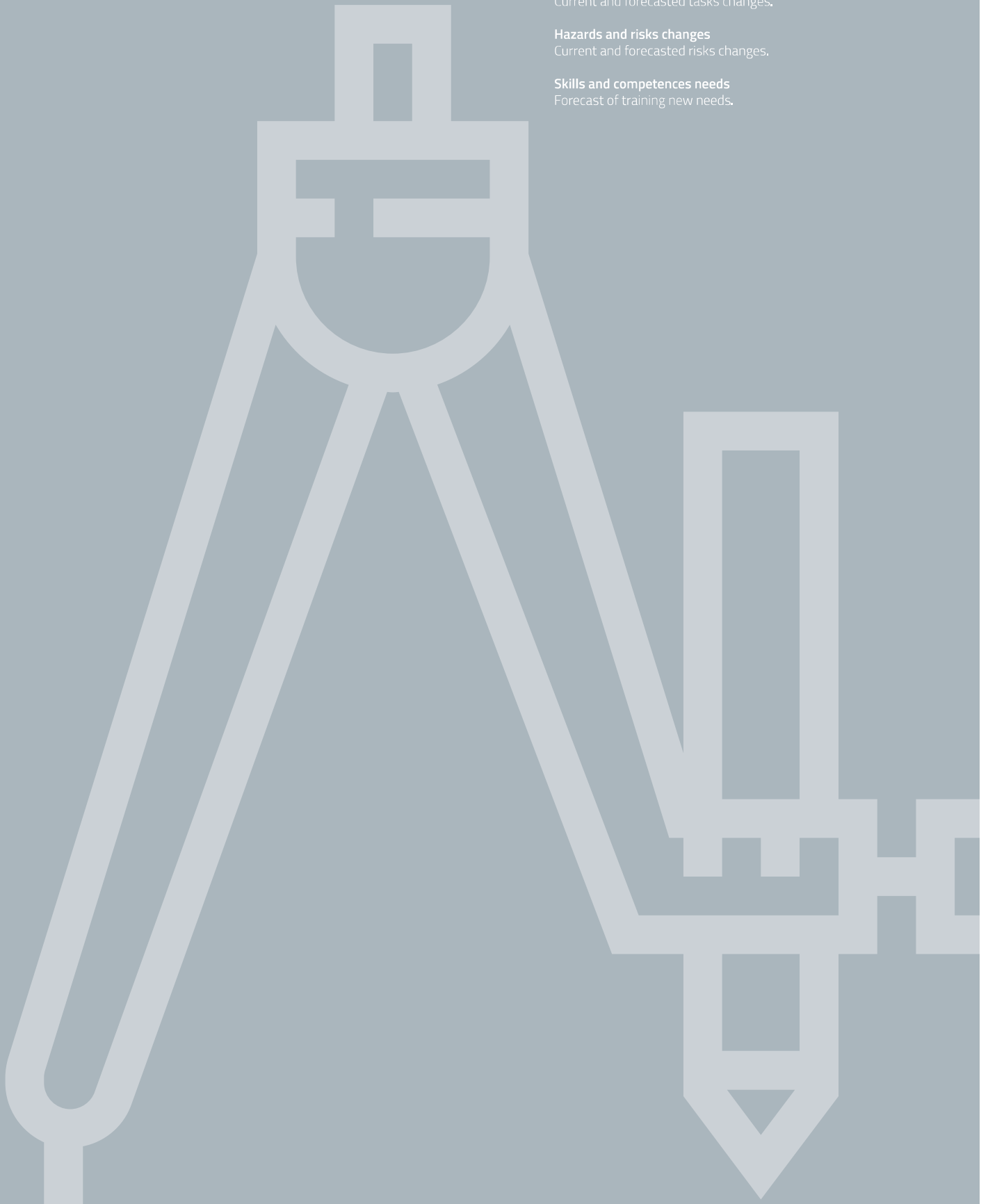
Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.



Tasks changes

Current and forecasted tasks changes due to sector digitization for the occupational profile furniture designers - ISCO 2163s



2025

Occupational profile

Probability of technologies adoption in the following groups of companies					Description forecast of the occupational profile in 2025 Furniture designers work on items of future furniture and related products exploiting the newest design methods, software and tools and the data and information collected through the highly connected and digitised company ecosystem. They design the product and are involved in its production as craftsmen and designers or makers. The conception of furniture combines innovative design, functional requirements and aesthetic appeal.
A1	A2	B1	B2		
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)	<ul style="list-style-type: none"> Use digitization tools to work in a customer-oriented manner. Considers cost- and time-effectiveness. Contributes to continuous improvement of work processes in the company. Cooperates with other departments (administrative, commercial, ICT and technical services). Assists in the implementation of quality assurance activities. 	
				<p>Profile tasks forecast</p> <p>A Determining the objectives and constraints of the design using real life computational simulation models and by consulting with clients and stakeholders.</p> <p>B Formulating design concepts, using rapid experimentation and digital models, for industrial, commercial and consumer products.</p> <p>C Use virtual models to help harmonizing aesthetic considerations with technical, functional, ecological and production requirements.</p> <p>D Make digital (virtual) models and physical samples and models through rapid prototyping to communicate design concepts.</p> <p>E Negotiating digital design solutions with clients, management, and sales and manufacturing staff.</p> <p>F Selecting, specifying and recommending functional and aesthetic materials, production methods and finishes for manufacturing using the highly digitised set of tools.</p> <p>G Detailing and documenting the selected digital design for production.</p> <p>H Preparing and commissioning physical and digital prototypes, models and samples.</p> <p>I Supervising the preparation of patterns, programmes and tooling, and of the digital manufacturing process.</p>	
High	Medium	Light	Light		
High	Medium	Light	Light		
High	High	Medium	Light		
High	High	Medium	Light		
High	High	Medium	Medium		
High	High	Medium	Medium		
High	High	Medium	Light		
High	High	Medium	Light		

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile furniture designers - ISCO 2163s

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work area Office workplace, computer workplace, meeting room, sales rooms, discussion with difficult clients, managers and manufacturing staff, workshop for preparing prototypes and patterns.</p>	<p>Work area Office workplace, computer workplace, meeting room, sales rooms, discussion with difficult clients, managers and manufacturing staff, workshop for preparing prototypes and patterns, use of complex software, use of digitisation tools.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> ▪ Mechanical hazards: (when working in workshops to prepare prototypes): from moving machines and tools. Effects: bruises, cuts and sharp injuries, crushing. ▪ Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises. 	<ul style="list-style-type: none"> ▪ Mechanical hazards: (when working in workshops to prepare prototypes): from moving machines and tools. Effects: bruises, cuts and sharp injuries, crushing. ▪ Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises.
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions and inactivity, prolonged sitting and from poor ergonomic practices with mobile devices. Effects: chronic neck and back pain, obesity and cardiovascular diseases. 	<ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions and inactivity, prolonged sitting and from poor ergonomic practices with mobile devices. Digitization put workers at risk of being exposed to ergonomic hazards such as lack of exercise/inactivity because of operating autonomous or semi-autonomous machines from office workstations. Inactivity may increase with further digitisation. Effects: chronic neck and back pain, obesity and cardiovascular diseases.
<p>Electrical hazards</p> <ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Effect: fatal accident. 	<ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Effect: fatal accident.
<p>Work environmental hazards</p> <ul style="list-style-type: none"> ▪ Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. Effects: eyestrain, headache, colds, cardiovascular problems. 	<ul style="list-style-type: none"> ▪ Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. Effects: eyestrain, headache, colds, cardiovascular problems.
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> ▪ Organisation of work/content of work: tight deadlines, performance pressure, high expectations regarding creativity, difficult negotiations, no clear distinction between private life and work life, overload, lack of training and information. ▪ Social relationship: difficult clients, difficult colleagues. ▪ Working method: working alone frequently, cooperation with other departments. Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders. 	<ul style="list-style-type: none"> ▪ Organisation of work/content of work: tight deadlines, performance pressure, high expectations regarding creativity, difficult negotiations, no clear distinction between private life and work life, overload, lack of training and information. ▪ Social relationship: difficult clients, difficult colleagues. ▪ Working method: working alone frequently, cooperation with other departments; digitization may increase long period of concentration working with computer and new software and performing multitasking, increased demand on flexibility as workers may work from everywhere with mobile devices. Workers are also at risk of being permanent available outside working hours. Workers are at risk of cognitive strain due to interactions between digitalized instruments and autonomous technologies. The use of cobots and other digital techniques may increase the risk of working alone and feeling isolated. Working in a customer-oriented manner require an increased flexibility. Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile furniture designers – ESCO 2163s

		Will it continue to be needed?	Main reasons of change				
			Exploiting the newest design methods, software and tools and the data and information collected through the highly connected and digitized company ecosystem	Use digitization tools to work in a customer-oriented manner	Using real life computational simulation models	Using rapid experimentation / rapid prototyping and digital/ virtual models	Digital design
Essential skills and competences	Adapt to new design materials	YES					
	Attend design meetings	YES, changed	▪	▪	▪	▪	▪
	Consult with design team	YES, changed	▪		▪	▪	
	Design original furniture	YES, changed	▪	▪	▪	▪	▪
	Develop design concept	YES, changed	▪	▪			▪
	Gather reference materials for artwork	NO					
	Monitor art scene developments	YES					
	Monitor exhibition designs	YES					
	Monitor sociological trends	YES					
	Monitor textile manufacturing developments	YES					
	Present detailed design proposals	YES, changed			▪	▪	
	Transfer designs	YES, changed	▪	▪		▪	
	Essential knowledge	Art history	YES				
Aesthetics		YES					
Copyright legislation		YES					
Design principles		YES, changed	▪	▪	▪	▪	▪
Engineering principles		YES, changed	▪		▪	▪	
Engineering processes		YES					
Ergonomics		YES					
Industrial design		YES, changed	▪		▪	▪	▪
Manufacturing processes		YES, changed			▪	▪	
Mathematics		NO					
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	▪	▪		▪	
	Collaboration Across Networks and Leading by Influence	NEW	▪	▪	▪	▪	▪
	Agility and Adaptability	NEW	▪	▪	▪	▪	▪
	Initiative and Entrepreneurship	NEW	▪		▪	▪	▪
	Effective Oral - Written Communication	NEW			▪		▪
	Assessing and Analyzing Information	NEW	▪	▪	▪	▪	▪
	Curiosity and Imagination	NEW			▪	▪	▪
	Digital literacy	NEW	▪	▪	▪	▪	▪
	Data security	NEW	▪	▪	▪	▪	▪

Cabinet-makers and related workers

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.





2025

Occupational profile

Probability of technologies adoption in the following groups of companies				
A1	A2	B1	B2	
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)	
High	Medium	Medium	Light	
High	High	High	Medium	
High	Medium	Medium	Light	
High	Medium	Medium	Light	
High	High	Medium	Light	

Description forecast of the occupational profile in 2025

Cabinet-makers and related workers make, decorate and repair wooden furniture, carts and other vehicles, wheels, parts, fittings, patterns, models and other wooden products using **highly digitized, connected and automated** woodworking machines and machine tools as well as specialized hand tools.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- **Use digitization tools** to work in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial, ICT and technical services).
- Assists in the implementation of quality assurance activities.

Profile tasks forecast

- Operating **connected, digitized and highly automated even autonomous** woodworking machines such as power saws, jointers, mortisers and shapers, and using hand tools to cut, shape and form parts and components.
- A**
- Selecting, controlling, mounting and replacement of cutting tools on the woodworking machines.
 - Operating **connected, digitized and highly automated** woodworking machines.
- B**
- Simulating, using digital twins, to study and optimise plans, verifying dimensions of articles to be made, or preparing specifications and checking the quality and fit of pieces in order to ensure adherence to specifications.**
- C**
- With the help of cobots** trim joints and fit parts and subassemblies together to autonomously form complete units using glue and clamps, and reinforcing joints using nails, screws or other fasteners.
- D**
- Through human-robot collaboration** make, restyle and repair various wooden articles such as cabinets, furniture, vehicles, scale models, sports equipment and other parts or products.
- E**
- Create designs, using digital simulation tools like digital twins and augmented reality, and decorate furniture and fixtures by inlaying wood or applying veneer and carving designs with the use of automated machines such as laser-cutting cobots and other human-robot collaboration.**
- F**
- Finishing surfaces of wooden articles or furniture **through highly automated, even autonomous machines, cobots and robots, that can be remotely operated (with the help of Augmented Reality) using big data.**

Cabinet-makers and related workers

ISCO 7522

2018 ▶▶

Occupational profile

Current profile description

Cabinet-makers and related workers make, decorate and repair wooden furniture, carts and other vehicles, wheels, parts, fittings, patterns, models and other wooden products using woodworking machines, machine tools and specialized hand tools.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Works in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial and technical services).
- Assists in the implementation of quality assurance activities.

Current profile tasks

A	Operating woodworking machines such as power saws, jointers, mortisers and shapers, and using hand tools to cut, shape and form parts and components. <ul style="list-style-type: none"> Selecting, controlling, mounting and replacement of cutting tools on the woodworking machines. Operating woodworking machines.
B	Studying plans, verifying dimensions of articles to be made, or preparing specifications and checking the quality and fit of pieces in order to ensure adherence to specifications.
C	Trimming joints and fitting parts and subassemblies together to form complete units using glue and clamps, and reinforcing joints using nails, screws or other fasteners.
D	Making, restyling and repairing various wooden articles such as cabinets, furniture, vehicles, scale models, sports equipment and other parts or products.
E	Decorating furniture and fixtures by inlaying wood or applying veneer and carving designs.
F	Finishing surfaces of wooden articles or furniture.

New categorization of hazards

	Mechanical hazards	Unprotected moving parts ¹	Parts with hazardous shapes (cutting, pointed, rough)	Moving means of transport and tools ²	Uncontrolled moving parts (flying objects, wood chips)	Slip and trips	Falls from height	Ergonomic hazards	Heavy loads/heavy dynamic work	Awkward position/unbalanced strain	Repetitive movements	Lack of exercise, inactivity	Electrical hazards	Electric shock	Hazards due to physical effects/physical agents	Noise	Vibration	Laser light	Fire and explosion hazards	Flammable substances	Work environment hazards	Poor lighting conditions	Climate	Poor ventilation	Hazards through dangerous substances	Dust	Solvents (neurotoxic, allergens)	Carcinogens	New materials (e.g. Nanomaterials)	Psychosocial hazards	Excessive workloads
A		■	■	■	■	■			■	■				■		■	■	■				■	■	■				■	■	■	■
B																						■	■	■						■	
C		■	■	■	■	■			■	■	■					■	■	■				■	■	■		■	■	■	■	■	
D		■	■	■	■	■			■	■	■			■		■	■	■				■	■	■		■	■	■	■	■	
E		■		■					■	■	■					■	■	■				■	■	■		■	■	■	■	■	
F			■	■		■			■	■	■					■	■	■				■	■	■		■	■	■	■	■	

■ No changes ■ New ones ■ Reduced

¹ Cobotics (Squeezing, bumping, crushing, cutting, amputation, drawing-in/trapping).

² Run over, roll over, falls from height.

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work area Workshops with wood processing machines, hand and power tools such as (sanders, circular/crosscut/ripsaws), wood storage, finishing of wood products.</p>	<p>Work area Workshops with wood processing machines, hand and power tools such as (sanders, circular/crosscut/ripsaws), wood storage, finishing of wood products, use of digitalized tools.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> ▪ Mechanical hazards from moving machines and tools. Woodworking machinery exposes workers to risks of being injured by unprotected moving parts, contact with moving blades (saw blade, drill, kick back etc), uncontrolled moving parts (flying objects, wood chips) and parts with hazardous shapes (cutting, pointed, rough). Effects: severe bruises, amputations, cuts and sharp injuries, crushing. ▪ Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises. 	<ul style="list-style-type: none"> ▪ Mechanical hazards from moving machines and tools and from cobots and robots. Woodworking machinery exposes workers to risks of being injured by unprotected moving parts, contact with moving blades (saw blade, drill, kick back etc), uncontrolled moving parts (flying objects, wood chips) and parts with hazardous shapes (cutting, pointed, rough). Some risks from mechanical hazards may decrease, depending on takeover of specific tasks by cobots/robots. Most of industrial cobots and robots are unaware of their surroundings, therefore, they can be dangerous to workers. Industrial robots can pose several types of hazards based on their origin: Mechanical hazards such as those arising from unintended and unexpected movements or release of tools. Effects: severe bruises, amputations, cuts and sharp injuries, crushing. ▪ Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises.
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> ▪ Ergonomic hazards: poor ergonomic conditions, heavy physical workload. Effect: musculoskeletal diseases. 	<ul style="list-style-type: none"> ▪ Ergonomic hazards: poor ergonomic conditions, heavy physical workload. Risks from ergonomic hazards may decrease, depending on takeover of specific tasks by cobots/robots. On the other hand, workers are increasingly exposed to ergonomic hazards such as lack of exercise/inactivity because of operating autonomous machines and cobots from computer workstations. Effect: musculoskeletal diseases.
<p>Electrical hazards</p> <ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Electrical hazards from woodworking machines. Effect: fatal accident. 	<ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Electrical hazards from woodworking machines and from autonomous or highly autonomous equipment. Effect: fatal accident.
<p>Hazards due to physical effects/physical agents</p> <ul style="list-style-type: none"> ▪ Noise Effects: hearing loss, headache, nervousness, poor concentration. ▪ Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease). 	<ul style="list-style-type: none"> ▪ Noise Effects: hearing loss, headache, nervousness, poor concentration. ▪ Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease). ▪ Exposure to noise and vibration may decrease, depending on takeover of specific tasks by cobots/robots. ▪ Laser: wood processing plant operators may be exposed to laser light. Effect: eye damage, negative effects similar to sunburn.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile Cabinet-makers and related workers - ISCO 7522

2018 Current situation	2025 Situation forecast
<p>Fire and explosion hazards</p> <ul style="list-style-type: none"> Explosion and fire hazards from materials, including wood dust, solvents and chemicals. Effects: burns, fatal accidents. 	<ul style="list-style-type: none"> Explosion and fire hazards from materials, including wood dust, solvents and chemicals. Exposure to fire and explosion hazards may decrease, depending on takeover of specific tasks by cobots/robots. Effects: burns, fatal accidents.
<p>Work environmental hazards</p> <ul style="list-style-type: none"> Work environmental hazards: poor lighting, climate and temperature. Effects: cardiovascular diseases, cold, eyestrain, headache. 	<ul style="list-style-type: none"> Work environmental hazards: poor lighting, climate and temperature. Effects: cardiovascular diseases, cold, eyestrain, headache.
<p>Hazards through dangerous substances</p> <ul style="list-style-type: none"> Hazards from dangerous substances: asbestos, glass fibre, vapours, fumes, dust, solvents, new materials (nanomaterials). Effects: contamination/intoxication, skin diseases, respiratory diseases, cancer. 	<ul style="list-style-type: none"> Hazards from dangerous substances: asbestos, glass fibre, vapours, fumes, dust, solvents, new materials (nanomaterials). The risk of being exposed to chemicals may decrease, depending on takeover of specific tasks by cobots/robots. Effects: contamination/intoxication, skin diseases, respiratory diseases, cancer. New materials (e.g. nanomaterials): Nanotechnology and nanomaterials may be used in woods as well as wood-composite materials in order to improve some of their properties, e.g. to improve the water resistance or thermal conductivity. Effects: not yet well known, included are among others inflammation and tissue damage, fibrosis and tumour generation.
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> Organisation of work: time pressure, shift work, stress, often related to poor work organisation lack of training. Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues. Working method: operating woodworking machines, working with colleagues. Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders. 	<ul style="list-style-type: none"> Organisation of work: time pressure, shift work, stress, often related to poor work organisation lack of training, increased demand on flexibility and digital know how, repetitive and monotonous work. Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues, lack of social contacts. Working method: working with colleagues, operating digital equipment, cognitive interactions with autonomous technologies. The use of cobots and other digital technologies may increase the risk of working alone and feeling isolated. Cognitive interactions between a robot and a human worker can lead to mental stress. Long period of concentration working with computer and new software and performing multitasking, increased demand on flexibility as workers may work from everywhere with mobile devices. Workers are also at risk of being permanent available outside working hours. Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile Cabinet-makers and related workers - ESCO 7522

		Will it continue to be needed?	Main reasons of change				
			Use digitization tools to work in a customer-oriented manner	Using highly digitized, connected and automated (autonomous) woodworking machines	Simulation and use of digital twins to study and optimize	Human-robot collaboration, use of robots, that can be remotely operated (with the help of Augmented Reality) using big data	Create designs, using digital simulation tools like digital twins and augmented reality
Essential skills and competences	Apply a protective layer	YES, changed		■		■	
	Apply wood finishes	YES, changed		■		■	
	Clean wood surface	YES, changed		■		■	
	Create furniture frames	YES, changed		■		■	
	Create smooth wood surface	YES, changed		■		■	
	Design objects to be crafted	YES, changed			■		■
	Design original furniture	YES, changed			■		■
	Join wood elements	YES, changed		■		■	
	Operate drilling equipment	YES, changed		■		■	
	Operate wood sawing equipment	YES, changed		■		■	
	Repair furniture frames	YES, changed		■		■	
	Sand wood	YES, changed		■		■	
	Tend boring machine	YES, changed		■		■	
	Essential knowledge	Construction products	YES, changed	■		■	
Furniture trends		YES, changed	■		■		
Sanding techniques		YES, changed		■		■	
Technical drawings		YES, changed	■		■		■
Types of wood		YES					
Wood products		YES					
Woodturning		YES, changed		■		■	
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	■	■	■	■	
	Collaboration Across Networks and Leading by Influence	NEW	■		■	■	■
	Agility and Adaptability	NEW	■	■	■	■	■
	Initiative and Entrepreneurship	NEW		■	■		■
	Effective Oral - Written Communication	NEW					■
	Assessing and Analyzing Information	NEW	■	■	■	■	■
	Curiosity and Imagination	NEW			■		■
	Digital literacy	NEW	■	■	■	■	■
	Data security	NEW	■		■		■

Woodworking machine tool setters and operators

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.





2025

Occupational profile

Probability of technologies adoption in the following groups of companies				
A1	A2	B1	B2	
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)	
				<p>Description forecast of the occupational profile in 2025</p> <p>Woodworking machine tool setters and operators set-up, operate and monitor semi-automatic or fully automated, even autonomous woodworking machines such as precision sawing, shaping, planing, boring, turning and woodcarving machines to fabricate or repair wooden parts for furniture, fixtures and other wooden products.</p> <ul style="list-style-type: none"> Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use. Use digitization software tools to work in a customer-oriented manner. Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence. Contributes to continuous improvement of work processes in the company. Coordinates work with the rest of the team, report to his/her team leader. Cooperates with other departments (administrative, commercial, ICT- and technical services). Assists in the implementation of quality assurance activities.
				<p>Profile tasks forecast</p>
High	High	Medium	Medium	<p>A Using digital quality management to verify dimensions of articles to be made, or preparing specifications and checking the quality and fit of pieces in order to ensure adherence to specifications.</p>
High	High	Medium	Light	<p>B Setting up, programming, operating and monitoring several types of connected woodworking machines for sawing, shaping, boring, drilling, planing, pressing, turning, sanding or carving to fabricate or repair wooden parts for furniture, fixtures and other wooden products.</p>
High	High	Medium	Light	<p>C Operating special-purpose automated and real-time optimized woodworking machines to fabricate wooden products such as coat hangers, mop handles, clothespins and other products.</p>
High	High	Medium	Medium	<p>D Setting up flexible connected machines/cobots for selecting knives, saws, blades, cutter heads, cams, bits or belts according to work piece, machine functions and product specifications.</p>
High	High	Medium	Light	<p>E Installing and adjusting blades, cutter heads, boring-bits and sanding-belts using cobots and semi-autonomous robots.</p>
High	High	Medium	Medium	<p>F Use cobots for the autonomous selection, control, mounting and replacing of cutting tools on the woodworking machines.</p>
High	High	High	Medium	<p>G Setting and adjusting through digitized and remote controls various kinds of connected woodworking machines for operation by others; studying and interpreting specifications using simulation models and mixed/augmented reality.</p>

Woodworking machine tool setters and operators

ISCO 7523

2018 ▶▶

Occupational profile

Current profile description

Woodworking machine tool setters and operators set-up, operate and monitor automatic or semi-automatic woodworking machines such as precision sawing, shaping, planing, boring, turning and woodcarving machines to fabricate or repair wooden parts for furniture, fixtures and other wooden products.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Works in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial and technical services).
- Assists in the implementation of quality assurance activities.

Current profile tasks

A	Verifying dimensions of articles to be made, or preparing specifications and checking the quality and fit of pieces in order to ensure adherence to specifications.
B	Setting up, programming, operating and monitoring several types of woodworking machines for sawing, shaping, boring, drilling, planing, pressing, turning, sanding or carving to fabricate or repair wooden parts for furniture, fixtures and other wooden products.
C	Operating preset special-purpose woodworking machines to fabricate wooden products such as coat hangers, mop handles, clothespins and other products.
D	Selecting knives, saws, blades, cutter heads, cams, bits or belts according to work piece, machine functions and product specifications.
E	Installing and adjusting blades, cutter heads, boring-bits and sanding-belts, and using hand tools and rules.
F	Selects, controls, mounts and replaces cutting tools on the woodworking machines.
G	Setting and adjusting various kinds of woodworking machines for operation by others; reading and interpreting specifications or following verbal instructions.

New categorization of hazards

	Mechanical hazards	Unprotected moving parts ¹	Parts with hazardous shapes (cutting, pointed, rough)	Moving means of transport and tools ²	Uncontrolled moving parts (flying objects, wood chips)	Slip and trips	Falls from height	Ergonomic hazards	Heavy loads/heavy dynamic work	Awkward position/unbalanced strain	Repetitive movements	Lack of exercise, inactivity	Electrical hazards	Electric shock	Hazards due to physical effects/physical agents	Noise	Vibration	Laser light	Fire and explosion hazards	Flammable substances	Work environment hazards	Poor lighting conditions	Climate	Poor ventilation	Hazards through dangerous substances	Dust	Solvents (neurotoxic, allergens)	Carcinogens	New materials (e.g. Nanomaterials)	Psychosocial hazards	Excessive workloads
A												■										■	■							■	
B	■	■	■				■					■		■		■	■					■	■						■	■	
C	■	■	■				■					■		■		■	■					■	■					■	■	■	
D	■	■	■	■			■					■		■		■	■					■	■							■	
E	■	■	■	■			■					■		■		■	■					■	■							■	
F	■	■	■	■			■					■		■		■	■					■	■							■	
G												■										■	■							■	

■ No changes ■ New ones ■ Reduced

¹ Cobotics (Squeezing, bumping, crushing, cutting, amputation, drawing-in/trapping).
² Run over, roll over, falls from height.

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work area Workshops with wood processing machines, hand and power tools such as (sanders, circular/crosscut/ripsaws), wood storage, finishing of wood products.</p>	<p>Work area Workshops with wood processing machines, hand and power tools such as (sanders, circular/crosscut/ripsaws), wood storage, finishing of wood products, use of digitalized tools, work, programming of semi- or fully automated, even autonomous machines, use of digitalized software tools.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> ▪ Mechanical hazards from moving machines and tools. Woodworking machinery exposes workers to risks of being injured by unprotected moving parts, contact with moving blades (saw blade, drill, kick back etc), uncontrolled moving parts (flying objects, wood chips) and parts with hazardous shapes (cutting, pointed, rough). Effects: severe bruises, amputations, cuts and sharp injuries, crushing. ▪ Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises. 	<ul style="list-style-type: none"> ▪ Mechanical hazards from moving machines and tools. Woodworking machinery exposes workers to risks of being injured by unprotected moving parts, contact with moving blades (saw blade, drill, kick back etc), uncontrolled moving parts (flying objects, wood chips) and parts with hazardous shapes (cutting, pointed, rough), and from cobots and robots. Effects: severe bruises, amputations, cuts and sharp injuries, crushing. Risks from mechanical hazards may decrease, depending on takeover of specific task by cobots/robots. ▪ Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises.
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload. Effect: musculoskeletal diseases. 	<ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload. Effect: musculoskeletal diseases. Ergonomic risks may decrease, depending on takeover of specific task by cobots/robots.
<p>Electrical hazards</p> <ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Effect: fatal accident. 	<ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Effect: fatal accident.
<p>Hazards due to physical effects/physical agents</p> <ul style="list-style-type: none"> ▪ Noise Effects: hearing loss, headache, nervousness, poor concentration. ▪ Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease). 	<ul style="list-style-type: none"> ▪ Noise Effects: hearing loss, headache, nervousness, poor concentration. ▪ Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease). Risk of being exposed to noise and vibration may decrease, depending on takeover of specific task by cobots/robots.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile Woodworking machine tool setters and operators - ISCO 7523

2018 Current situation	2025 Situation forecast
<p>Work environmental hazards</p> <ul style="list-style-type: none"> Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation. <p>Effect: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.</p>	<ul style="list-style-type: none"> Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation. <p>Effect: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.</p>
<p>Hazards through dangerous substances</p> <ul style="list-style-type: none"> Chemical hazards: wood dust. <p>Effects: contamination/intoxication, respiratory diseases, wood dusts (carcinogens, allergens) may cause nasal or lung cancer. Wood dust may put workers at risk of explosions.</p>	<ul style="list-style-type: none"> Chemical hazards: wood dust. <p>Effects: contamination/intoxication, respiratory diseases, wood dusts (carcinogens, allergens) may cause nasal or lung cancer. Wood dust may put workers at risk of explosions.</p> <p style="color: #e67e22;">Exposure to chemicals (wood dust) may decrease, depending on takeover of specific task by cobots/robots.</p> <ul style="list-style-type: none"> New materials (e.g. nanomaterials): Nanotechnology and nanomaterials may be used in woods as well as wood-composite materials in order to improve some of their properties, e.g. to improve the water resistance or thermal conductivity. <p style="color: #e67e22;">Effects: not yet well known, included are among others inflammation and tissue damage, fibrosis and tumour generation.</p>
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility, repetitive, monotonous work. Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues. Working method: working with colleagues. <p>Effects: stress, burnout.</p>	<ul style="list-style-type: none"> Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility and digital know how, repetitive, monotonous work. Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues, lack of social contacts. Working method: working with colleagues, digital equipment, cognitive interactions with autonomous equipment. The use of cobots and other digital techniques may increase the risk of working alone and feeling isolated. Cognitive interactions between a robot and a human worker can lead to mental stress. Long period of concentration working with computer and new software and performing multitasking. Increased demand on flexibility as workers may perform some tasks from everywhere with mobile devices. Workers are also at risk of being permanent available outside working hours. <p>Effects: stress, burnout.</p>

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile Woodworking-machine tool setters and operators - ESCO 7523

		Will it continue to be needed?	Main reasons of change				
			Use digitization tools to work in a customer-oriented manner	Setting up flexible connected machines/cobots	Using highly digitized, connected and automated (autonomous) woodworking machines	Human-robot collaboration, use of cobots, that can be remotely operated (with help of AR) using big data, simulation models and mixed/augmented reality	Using digital quality management
Essential skills and competences	Consult technical resources	YES					
	Dispose of cutting waste material	YES					
	Maintain furniture machinery	NO					
	Monitor automated machines	YES, changed	■			■	■
	Operate furniture machinery	YES, changed		■	■	■	
	Remove inadequate workpieces	YES, changed					■
	Remove processed workpiece	NO					
	Set up the controller of a machine	YES, changed		■			
	Supply machine	YES					
	Supply machine with appropriate tools	YES, changed		■	■	■	
Essential knowledge	Machine tools	YES					
	Quality standards	YES, changed					■
	Types of wood	NO					
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	■		■	■	■
	Collaboration Across Networks and Leading by Influence	NEW	■			■	
	Agility and Adaptability	NEW	■	■	■	■	■
	Initiative and Entrepreneurship	NEW			■		
	Effective Oral - Written Communication						
	Assessing and Analyzing Information	NEW	■	■	■	■	■
	Curiosity and Imagination						
	Digital literacy	NEW	■	■	■	■	■
	Data security	NEW	■			■	

Upholsterers and related workers

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

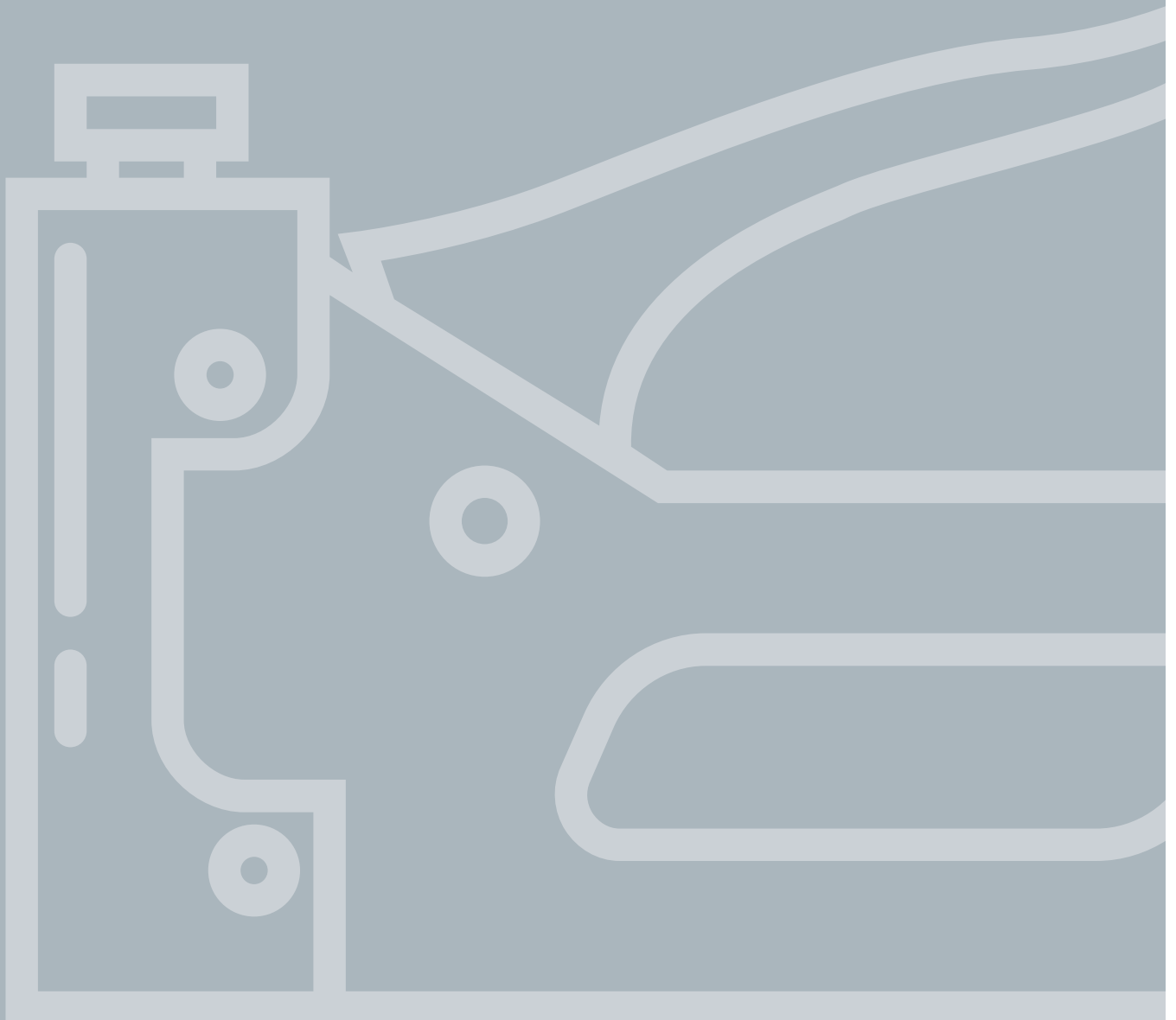
Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.



Tasks changes

Current and forecasted tasks changes due to sector digitization for the occupational profile Upholsterers and related workers- ISCO 7534



2025

Occupational profile

Probability of technologies adoption in the following groups of companies				
A1	A2	B1	B2	
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)	
High	High	High	Medium	A Using digital simulation models, discussing upholstery fabric, colour and style with customers and providing cost estimates for upholstering furniture or other items.
High	High	High	Medium	B Using computer vision and digital twin simulation models, verifying dimensions of articles to be made, or preparing specifications and checking the quality and fit of pieces in order to ensure adherence to specifications.
High	High	Medium	Medium	C Making upholstery patterns from digital models, sketches, customer descriptions.
High	High	Medium	Medium	D Laying out, measuring and cutting upholstery materials using advanced digital process control following patterns, templates, sketches or design specifications.
High	Medium	Light	Light	E Highly automated installing, arranging and securing springs, padding and covering material to furniture frames.
High	Medium	Light	Light	F Sewing upholstery materials to seam cushions and joining sections of covering materials using semi-automated processes and connected cobots.
High	Medium	Light	Light	G Using computer vision and big data analytics to automate the process of sewing rips or tears in material, or creating tufting, using fully automated cobots with needle and thread or semi-autonomous machines for sewing-/locking.
High	Medium	Light	Light	H Semi-autonomously tacking, gluing or sewing ornamental trims, buckles, braids, buttons and other accessories to covers or frames on upholstered items using cobots.
High	High	Medium	Light	I Highly automated laying out, cutting, fabricating and installing upholstery using autonomous robots connected to the big data cloud: <ul style="list-style-type: none"> Installing upholstery on the structure. Finishing of the upholstery.
Medium	Medium	Light	Light	J Renovating antique furniture with highly automated machines and cobots using a variety of tools including ripping chisels, magnetic hammers and long needles. <ul style="list-style-type: none"> Ripping off the seats and sofas. Demounting of the (structural) parts. Renovating of the upholstery.
High	High	Medium	Medium	K Using digital models and augmented reality to collaborate with interior designers to decorate rooms and coordinate furnishing fabrics.
High	High	Medium	Light	L Fully automated manufacturing of quilts, cushions and mattresses. <ul style="list-style-type: none"> Filling up cushions. Filling up mattresses.

Description forecast of the occupational profile in 2025

Upholsterers and related workers install, repair and replace upholstery of furniture, fixtures, seats, panels, convertible and vinyl tops and other furnishings of automobiles, railway coaches, aircraft, ships and similar items with fabric, leather, rexine or other upholstery material using semi-automated or fully automated machines. They also make and repair cushions, quilts and mattresses.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Use digitization tools to work in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial, ICT- and technical services).
- Assists in the implementation of quality assurance activities.

Profile tasks forecast

Upholsterers and related workers

ISCO 7534

2018 ▶▶

Occupational profile

Current profile description

Upholsterers and related workers install, repair and replace upholstery of furniture, fixtures, seats, panels, convertible and vinyl tops and other furnishings of automobiles, railway coaches, aircraft, ships and similar items with fabric, leather, rexine or other upholstery material. They also make and repair cushions, quilts and mattresses.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Works in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial and technical services).
- Assists in the implementation of quality assurance activities.

Current profile tasks

A	Discussing upholstery fabric, colour and style with customers and providing cost estimates for upholstering furniture or other items.
B	Verifying dimensions of articles to be made, or preparing specifications and checking the quality and fit of pieces in order to ensure adherence to specifications.
C	Making upholstery patterns from sketches, customer descriptions or blueprints.
D	Laying out, measuring and cutting upholstery materials following patterns, templates, sketches or design specifications.
E	Installing, arranging and securing springs, padding and covering material to furniture frames.
F	Sewing upholstery materials by hand to seam cushions and joining sections of covering materials.
G	Sewing rips or tears in material, or creating tufting, using needle and thread or hand operated machines for sewing-/locking.
H	Tacking, gluing or sewing ornamental trims, buckles, braids, buttons and other accessories to covers or frames on upholstered items.
I	Laying out, cutting, fabricating and installing upholstery: <ul style="list-style-type: none"> • Installing upholstery on the structure. • Finishing of the upholstery.
J	Renovating antique furniture using a variety of tools including ripping chisels, magnetic hammers and long needles: magnetic hammers and long needles: <ul style="list-style-type: none"> • Ripping off the seats and sofas. • Demounting of the (structural) parts. • Renovating of the upholstery.
K	Collaborating with interior designers to decorate rooms and coordinate furnishing fabrics.
L	Making quilts, cushions and mattresses. <ul style="list-style-type: none"> • Filling up cushions. • Filling up mattresses.



New categorization of hazards

	Mechanical hazards	Unprotected moving parts ¹	Parts with hazardous shapes (cutting, pointed, rough)	Moving means of transport and tools ²	Uncontrolled moving parts (flying objects, wood chips)	Slip and trips	Falls from height	Ergonomic hazards	Heavy loads/heavy dynamic work	Awkward position/unbalanced strain	Repetitive movements	Lack of exercise, inactivity	Electrical hazards	Electric shock	Hazards due to physical effects/physical agents	Noise	Vibration	Laser/light	Fire and explosion hazards	Flammable substances	Work environment hazards	Poor lighting conditions	Climate	Poor ventilation	Hazards through dangerous substances	Dust	Solvents (neurotoxic, allergens)	Carcinogens	New materials (e.g. Nanomaterials)	Psychosocial hazards	Excessive workloads
A												■																			■
B												■																			■
C												■																			■
D		■	■			■			■			■		■		■	■	■											■		■
E		■	■		■	■			■			■		■		■	■												■		■
F		■	■			■			■			■		■		■	■												■		■
G		■	■			■			■			■		■		■	■												■		■
H		■	■			■			■			■		■		■	■									■	■	■		■	■
I		■	■			■			■			■		■		■	■								■				■		■
J		■	■			■			■			■		■		■	■												■		■
K												■																			■
L												■				■	■									■			■		■

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work area Workshops with upholsterer machines (sewing machine), hand and power tools such as (steam iron, pneumatic staple gun, tack hammer, scissors, hammer, knife, pliers, screwdrivers, hand brushes, hot melt glue guns), on-site workplaces (cars, airplanes, ships and others), discussion with clients and textile salesmen.</p>	<p>Work area Workshops with upholsterer machines (sewing machine), hand and power tools such as (steam iron, pneumatic staple gun, tack hammer, scissors, hammer, knife, pliers, screwdrivers, hand brushes, hot melt glue guns), on-site workplaces (cars, airplanes, ships and others), discussion with clients and textile salesmen, use of digitalized instruments.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> Mechanical hazards from moving machines and tools. Machinery used in upholstery exposes workers to risks of being injured by unprotected moving parts, uncontrolled moving parts (air tools/electric staplers, springs) and parts with hazardous shapes (cutting, pointed, rough). Effects: severe bruises, cuts and sharp injuries. Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises. 	<ul style="list-style-type: none"> Mechanical hazards from moving machines and tools. Machinery used in upholstery exposes workers to risks of being injured by unprotected moving parts, uncontrolled moving parts (air tools/electric staplers, springs) and parts with hazardous shapes (cutting, pointed, rough), and from cobots and robots. Effects: severe bruises, cuts and sharp injuries. Risks from mechanical hazards may decrease, depending on takeover of specific task by cobots/robots. Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises.
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> Ergonomic hazards: from poor ergonomic conditions, awkward positions. Effect: musculoskeletal diseases. 	<ul style="list-style-type: none"> Ergonomic hazards: from poor ergonomic conditions, awkward positions. Effect: musculoskeletal diseases. Risks from ergonomic hazards may decrease, depending on takeover of specific task by cobots/robots. On the other hand, workers are increasingly exposed to ergonomic hazards such as lack of exercise/inactivity because of operating autonomous machines and cobots from computer workstations.
<p>Electrical hazards</p> <ul style="list-style-type: none"> Electric hazards: contacts with live parts or connections or exposure to arc flash. Effect: fatal accident. 	<ul style="list-style-type: none"> Electric hazards: contacts with live parts or connections or exposure to arc flash. Effect: fatal accident.
<p>Hazards due to physical effects/physical agents</p> <ul style="list-style-type: none"> Noise Effects: hearing loss, headache, nervousness, poor concentration. Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease). 	<ul style="list-style-type: none"> Noise Effects: hearing loss, headache, nervousness, poor concentration. Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease). Exposure to noise and vibration risks may decrease, depending on takeover of specific task by cobots/robots. Laser light: exposure to laser light from laser cutting machines used to cut leather and other fabrics. Effects: eye and skin injuries resulting from a direct laser beam or a reflection of the beam.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile Upholsterers and related workers - ISCO 7534

2018 Current situation	2025 Situation forecast
<p>Fire and explosion hazards</p> <ul style="list-style-type: none"> Explosion and fire hazards from materials, including glue, solvents and other chemicals. Effects: burns, fatal accidents. 	<ul style="list-style-type: none"> Explosion and fire hazards from materials, including glue, solvents and other chemicals. Risks from explosion and fire may decrease, depending on takeover of specific task by cobots/robots. Effects: burns, fatal accidents.
<p>Work environmental hazards</p> <ul style="list-style-type: none"> Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation. Effect: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain. 	<ul style="list-style-type: none"> Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation. Effect: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.
<p>Hazards through dangerous substances</p> <ul style="list-style-type: none"> Chemical hazards: wood dust, solvents, preservatives, formaldehyde, glues. Upholsterers usually require an extensive use of solvents. High risk of fire and explosion due to the presence of flammable solvents/glues and other flammable material and the accumulation of solvent vapours, particularly in small, unventilated areas. Effects: contamination/intoxication, skin diseases, respiratory diseases, allergies, cancer. 	<ul style="list-style-type: none"> Chemical hazards: wood dust, solvents, preservatives, formaldehyde, glues, new substances/materials. Upholsterers usually require an extensive use of solvents. High risk of fire and explosion due to the presence of flammable solvents/glues and other flammable material and the accumulation of solvent vapours, particularly in small, unventilated areas. Effects: contamination/intoxication, skin diseases, respiratory diseases, allergies, cancer. Exposure to chemicals may decrease, depending on takeover of specific task by cobots/robots. New materials (e.g. nanomaterials): Nanotechnology and nanomaterials may be used in woods as well as wood-composite materials in order to improve some of their properties, e.g. to improve the water resistance or thermal conductivity. Effects: not yet well known, included are among others inflammation and tissue damage, fibrosis and tumour generation.
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility, repetitive work. Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues. Working method: working with colleagues. 	<ul style="list-style-type: none"> Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility and digital know how, repetitive work. Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues, lack of social contacts. Working method: working with colleagues, digital equipment, cognitive interactions with autonomous technologies. The use of cobots and other digital techniques may increase the risk of working alone and feeling isolated. Cognitive interactions between a robot and a human worker can lead to mental stress. Long period of concentration working with computer and new software and performing multitasking. Increased demand on flexibility as workers may perform some tasks from everywhere with mobile devices. Workers are also at risk of being permanent available outside working hours.

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile Upholsterers and related workers - ESCO 7534

		Will it continue to be needed?	Main reasons of change			
			Using semi-automated or fully automated operating machines and connected cobots	Use digitization tools to work in a customer-oriented manner	Using digital simulation models, computer vision and digital twin simulation models	Using advanced digital process control
Essential skills and competences	Clean furniture	YES				
	Create patterns for textile products	YES, changed		■	■	■
	Cut textiles	YES, changed	■	■	■	■
	Decorate furniture	YES				
	Fasten components	YES, changed	■		■	
	Install spring suspension	YES, changed	■			
	Perform upholstery repair	YES, changed	■			
	Provide customized upholstery	YES, changed	■	■	■	
	Sew pieces of fabric	YES, changed	■		■	■
	Sew textile-based articles	YES, changed	■	■	■	■
	Use manual sewing techniques	NO				
Essential knowledge	Furniture industry	YES				
	Furniture trends	YES				
	Textile materials	YES, changed	■		■	
	Upholstery fillings	YES, changed	■		■	
	Upholstery tools	YES, changed	■			
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	■	■		■
	Collaboration Across Networks and Leading by Influence	NEW		■	■	
	Agility and Adaptability	NEW	■	■	■	■
	Initiative and Entrepreneurship	NEW	■		■	
	Effective Oral - Written Communication	NEW			■	
	Assessing and Analyzing Information	NEW	■	■	■	■
	Curiosity and Imagination	NEW			■	
	Digital literacy	NEW	■	■	■	■
	Data security	NEW		■	■	■

Wood processing plant operators

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.



Wood processing plant operators

ISCO 8172

2018 ▶▶

Occupational profile

Current profile description

Wood processing plant operators monitor, operate and control lumber mill equipment for sawing timber logs into rough lumber, cutting veneer, making plywood and particle board, and otherwise preparing wood for further use.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Works in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial and technical services).
- Assists in the implementation of quality assurance activities.

Current profile tasks

A	Examining logs and rough lumber to determine size, condition, quality and other characteristics to decide best lumber cuts to carry out, or operating automated equipment to convey logs through laser scanners which determine the most productive and profitable cutting patterns.
B	Operating and monitoring log in-feed and conveyor systems.
C	Preparation of the work, by removing strange elements (in metal, stone...), removing bark, etc...
D	Operating and monitoring head saws, resaws and multiblade saws to saw logs, cants, flitches, slabs or wings and remove rough edges from sawn timber into dressed lumber of various sizes, and to saw or split shingles and shakes.
E	Selecting, controlling, mounting and replacement of cutting tools on the woodworking machines.
F	Operating and monitoring plywood core-laying machines and hot-plate plywood presses and machines which cut veneer.
G	Cleaning and lubricating sawmill equipment.



	McKinsey Levers											Industry 4.0 technologies							Forecast temporal horizon for change
	Resource process	Asset utilization			Labor		Inventories	Quality		Supply/demand match	Time to market								
	Smart energy consumption Real-time yield optimization	Intelligent Lots Routing flexibility Machine flexibility	Remote monitoring and control Predictive maintenance	Augmented reality for MRO Human-robot collaboration	Remote monitoring and control Automation of knowledge work	Digital performance management Batch size 1	Real-time SC optimization In situ 3D printing	Digital quality management Statistical process control (SPC)	Advanced process control (APC) Data-driven demand prediction	Data-driven design to value Rapid experimentation and simulation	Customer co-creation/open innovation Concurrent engineering	Big data and analytics Autonomous robots	Simulation Horizontal and vertical system integration	The industrial internet of things Cybersecurity	The cloud Additive manufacturing	Augmented reality			
A	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	before 2025		
B	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	before 2025		
C	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	after 2025		
D	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	before 2025		
E	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	before 2025		
F	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	2025		
G	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	before 2025		



2025

Occupational profile

Probability of technologies adoption in the following groups of companies				
A1	A2	B1	B2	
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)	
High	Medium	Medium	Medium	
High	High	Medium	Medium	
High	High	Medium	Medium	
High	High	High	Medium	
High	High	High	Medium	
High	Medium	Medium	Light	
High	High	Medium	Medium	

Description forecast of the occupational profile in 2025

Wood processing plant operators monitor, operate and control digitized, connected and automated lumber mill equipment for sawing timber logs into rough lumber, cutting veneer, making plywood and particle board, and otherwise preparing wood for further use.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Use digitization tools to work in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial, ICT- and technical services).
- Assists in the implementation of quality assurance activities.

Profile tasks forecast

A Examining logs and rough lumber, using **fulled automated, computer vision, big data and cloud connectivity** to determine size, condition, quality and other characteristics to decide best lumber cuts to carry out, or operate automated equipment to convey logs through different sensors, like laser scanners, to determine the most productive and profitable cutting patterns.

B Operating and monitoring log **autonomous and highly automated** in-feed and conveyor systems.

C **Automated, semi-automated** preparation of the work, by removing strange elements (in metal, stone...), removing bark, etc...

D **Fully automated** operating and monitoring head saws, resaws and multiblade saws to saw logs, cants, flitches, slabs or wings and remove rough edges from sawn timber into dressed lumber of various sizes, and to saw or split shingles and shakes.

E **Autonomous** selection, controlling, mounting and replacement of cutting tools on the **highly digitized connected** woodworking machines.

F **Automated** operating and **remote** monitoring of **digitized** plywood core-laying machines and hot-plate plywood presses and machines which cut veneer.

G **Data driven predictive maintenance and quality assurance through** cleaning and lubricating of sawmill equipment.

Wood processing plant operators

ISCO 8172

2018 ▶▶

Occupational profile

Current profile description

Wood processing plant operators monitor, operate and control lumber mill equipment for sawing timber logs into rough lumber, cutting veneer, making plywood and particle board, and otherwise preparing wood for further use.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Works in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial and technical services).
- Assists in the implementation of quality assurance activities.

Current profile tasks

A	Examining logs and rough lumber to determine size, condition, quality and other characteristics to decide best lumber cuts to carry out, or operating automated equipment to convey logs through laser scanners which determine the most productive and profitable cutting patterns.
B	Operating and monitoring log in-feed and conveyor systems.
C	Preparation of the work, by removing strange elements (in metal, stone...), removing bark, etc...
D	Operating and monitoring head saws, resaws and multiblade saws to saw logs, cants, flitches, slabs or wings and remove rough edges from sawn timber into dressed lumber of various sizes, and to saw or split shingles and shakes.
E	Selecting, controlling, mounting and replacement of cutting tools on the woodworking machines.
F	Operating and monitoring plywood core-laying machines and hot-plate plywood presses and machines which cut veneer.
G	Cleaning and lubricating sawmill equipment.

New categorization of hazards

	Mechanical hazards	Unprotected moving parts ¹	Parts with hazardous shapes (cutting, pointed, rough)	Moving means of transport and tools ²	Uncontrolled moving parts (flying objects, wood chips)	Slip and trips	Falls from height	Ergonomic hazards	Heavy loads/heavy dynamic work	Awkward position/unbalanced strain	Repetitive movements	Lack of exercise, inactivity	Electrical hazards	Electric shock	Hazards due to physical effects/physical agents	Noise	Vibration	Laser light	Fire and explosion hazards	Flammable substances	Work environment hazards	Poor lighting conditions	Climate	Poor ventilation	Hazards through dangerous substances	Dust	Solvents (neurotoxic, allergens)	Carcinogens	New materials (e.g. Nanomaterials)	Psychosocial hazards	Excessive workloads
A		■		■		■						■				■						■	■							■	
B												■				■	■					■	■	■		■				■	
C		■	■	■	■	■			■	■				■		■						■	■	■		■				■	
D		■	■		■	■			■	■		■				■	■					■	■		■					■	
E							■					■				■	■					■	■							■	
F		■										■				■	■					■	■					■		■	
G		■								■		■		■		■				■		■	■			■	■	■		■	

■ No changes ■ New ones ■ Reduced

¹ Cobotics (Squeezing, bumping, crushing, cutting, amputation, drawing-in/trapping).
² Run over, roll over, falls from height

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile wood processing plant operators - ISCO 8172



2025

Occupational profile

Low job satisfaction	Work tasks not clearly defined	Poor organisation of work	Poorly designed workplace environment (incl. software)	Repetitive, monotonous work	Cognitive strain	Stress due to long period concentration and awareness	Increased demands on flexibility	Lack of work experience	Lack of involvement in making decisions that affect the worker	Ineffective communication, lack of support from management or colleagues	Working alone/isolation	Workload: overload/underload
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Description forecast of the occupational profile in 2025

- Wood processing plant operators monitor, operate and control digitized, connected and automated lumber mill equipment for sawing timber logs into rough lumber, cutting veneer, making plywood and particle board, and otherwise preparing wood for further use.
- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
 - Use digitization tools to work in a customer-oriented manner.
 - Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
 - Contributes to continuous improvement of work processes in the company.
 - Coordinates work with the rest of the team, report to his/her team leader.
 - Cooperates with other departments (administrative, commercial, ICT- and technical services).
 - Assists in the implementation of quality assurance activities.

Profile hazards forecast

		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	A
													Examining logs and rough lumber, using fully automated, computer vision, big data and cloud connectivity to determine size, condition, quality and other characteristics to decide best lumber cuts to carry out, or operate automated equipment to convey logs through different sensors, like laser scanners, to determine the most productive and profitable cutting patterns.
		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	B
													Operating and monitoring log autonomous and highly automated in-feed and conveyor systems.
		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	C
													Automated, semi-automated preparation of the work, by removing strange elements (in metal, stone...), removing bark, etc...
		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	D
													Fully automated operating and monitoring head saws, resaws and multiblade saws to saw logs, cants, flitches, slabs or wings and remove rough edges from sawn timber into dressed lumber of various sizes, and to saw or split shingles and shakes.
		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	E
													Autonomous selection, controlling, mounting and replacement of cutting tools on the highly digitized connected woodworking machines.
		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	F
													Automated operating and remote monitoring of digitized plywood core-laying machines and hot-plate plywood presses and machines which cut veneer.
		▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	G
													Data driven predictive maintenance and quality assurance through cleaning and lubricating of sawmill equipment.

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work area Working on a timber yard, saw/lumber mill, operate and control lumber mill equipment, operate machines to prepare plywood and particle wood, programming of machines, storing and transporting raw timber, handling heavy timber.</p>	<p>Work area Working on a timber yard, saw/lumber mill, operate and control digitised and automated lumber mill equipment, operate machines to prepare plywood and particle wood, programming of machines, storing and transporting raw timber, handling heavy timber.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> ▪ Mechanical hazards from moving machines and tools. Wood processing machinery exposes workers to risks of being injured by unprotected moving parts, contact with moving blades (saw blade, drill, kick back etc), uncontrolled moving parts (flying objects, wood chips) and parts with hazardous shapes (cutting, pointed, rough). Effects: severe bruises, amputations, cuts and sharp injuries, crushing. ▪ Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises. 	<ul style="list-style-type: none"> ▪ Mechanical hazards from moving machines and tools. Wood processing machinery exposes workers to risks of being injured by unprotected moving parts, contact with moving blades (saw blade, drill, kick back etc), uncontrolled moving parts (flying objects, wood chips) and parts with hazardous shapes (cutting, pointed, rough), and from moving cobots and robots. Effects: severe bruises, amputations, cuts and sharp injuries, crushing. Risks from mechanical hazards may decrease, depending on takeover of specific task by cobots/robots. Effect: musculoskeletal diseases, overweight, cardiovascular problems. ▪ Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises.
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload. Effect: musculoskeletal diseases. 	<ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload, digitization put workers at risk of inactivity because of operating autonomous techniques from office workstations. Effect: musculoskeletal diseases. Risks from ergonomic hazards may decrease, depending on takeover of specific task by cobots/robots. On the other hand, workers are increasingly exposed to ergonomic hazards such as lack of exercise/inactivity because of operating autonomous machines and cobots from computer workstations. Inactivity may increase with digitisation.
<p>Electrical hazards</p> <ul style="list-style-type: none"> ▪ Electrical hazards: caused by contact with defective or unearthed electrical equipment. Effect: fatal accident. 	<ul style="list-style-type: none"> ▪ Electrical hazards: caused by contact with defective or unearthed electrical equipment. Effect: fatal accident.
<p>Hazards due to physical effects/physical agents</p> <ul style="list-style-type: none"> ▪ Noise Effects: hearing loss, headache, nervousness, poor concentration. ▪ Vibrations Effects: hand–arm–vibration syndrome (e.g. white finger disease). 	<ul style="list-style-type: none"> ▪ Noise Effects: hearing loss, headache, nervousness, poor concentration. ▪ Vibrations Effects: hand–arm–vibration syndrome (e.g. white finger disease). The risk of being exposed to noise and vibration may decrease, depending on takeover of specific task by cobots/robots. ▪ Laser: Wood processing plant operators may be exposed to laser light. Effect: eye damage, effects similar to sunburn.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile wood processing plant operators - ISCO 8172

2018 Current situation	2025 Situation forecast
<p>Fire and explosion hazards</p> <ul style="list-style-type: none"> Explosion and fire hazards from materials, including wood dust and chemicals. Effects: burns, fatal accidents. 	<ul style="list-style-type: none"> Explosion and fire hazards from materials, including wood dust and chemicals. Effects: burns, fatal accidents.
<p>Work environmental hazards</p> <ul style="list-style-type: none"> Work environmental hazards: poor lighting, inadequate temperature and climate. Effect: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain. 	<ul style="list-style-type: none"> Work environmental hazards: poor lighting, inadequate temperature and climate. Effect: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.
<p>Hazards through dangerous substances</p> <ul style="list-style-type: none"> Chemical hazards: wood dust, preservatives, formaldehyde. Effects: contamination/intoxication, skin diseases, respiratory diseases, wood dusts (carcinogens, allergens) may cause nasal or lung cancer. Wood dust may put workers at risk of explosions. Biological hazards: bacteria, mould and fungi. Effects: contamination/intoxication, skin diseases, respiratory diseases, infections. 	<ul style="list-style-type: none"> Chemical hazards: wood dust, preservatives, formaldehyde. Effects: contamination/intoxication, skin diseases, respiratory diseases, wood dusts (carcinogens, allergens) may cause nasal or lung cancer. Wood dust may put workers at risk of explosions. The risk of being exposed to chemicals may decrease, depending on takeover of specific task by cobots/robots. New materials (e.g. nanomaterials): Nanotechnology and nanomaterials may be used in woods as well as wood-composite materials in order to improve some of their properties, e.g. to improve the water resistance or thermal conductivity. Effects: not yet well known, included are among others inflammation and tissue damage, fibrosis and tumour generation. Biological hazards: bacteria, mould and fungi. Effects: contamination/intoxication, skin diseases, respiratory diseases, infections. Risks may decrease with use of cobots/robots.
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility, repetitive, monotonous work. Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues. Working method: working with colleagues. Effects: stress, burnout. 	<ul style="list-style-type: none"> Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility and digital know how, repetitive, monotonous work. Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues, lack of social contacts. Working method: working with colleagues, autonomous machines/equipment, cognitive interactions with autonomous technologies. The use of cobots and other digital techniques may increase the risk of working alone and feeling isolated. Cognitive interactions between a robot and a human worker can lead to mental stress. Long period of concentration working with computer and new software and performing multitasking. Increased demand on flexibility as workers may perform some tasks from everywhere with mobile devices. Workers are also at risk of being permanent available outside working hours. Effects: stress, burnout.

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile wood processing plant operators - ESCO 8172

		Will it continue to be needed?	Main reasons of change		
			Operating digitized, connected and fully automated/ autonomous machines	Use of computer vision, big data and cloud connectivity	Using remote monitoring and data driven predictive maintenance and quality assurance
Essential skills and competences	Adjust properties of cut	YES, changed	■		
	Create cutting plan	YES, changed	■		
	Dispose of cutting waste material	YES			
	Ensure conformity to specifications	YES, changed		■	■
	Ensure equipment availability	YES			
	Handle timber	NO			
	Handle timber-based products	NO			
	Keep sawing equipment in good condition	YES, changed		■	■
	Manipulate wood	YES, changed	■	■	
	Monitor automated machines	YES			
	Operate wood sawing equipment	YES, changed	■	■	
	Perform test run	NO			
	Remove inadequate workpieces	NO			
	Remove processed workpiece	NO			
	Supply machine	YES			
	Troubleshoot	YES, changed		■	■
	Wear appropriate protective gear	YES			
Work safely with machines	YES				
Essential knowledge	Cutting technologies	YES			
	Types of wood	YES			
	Wood cuts	YES			
	Woodworking processes	YES, changed	■	■	
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	■	■	■
	Collaboration Across Networks and Leading by Influence	NEW		■	
	Agility and Adaptability	NEW	■	■	■
	Initiative and Entrepreneurship	NEW	■	■	
	Effective Oral and Written Communication				
	Assessing and Analyzing Information	NEW	■	■	■
	Curiosity and Imagination				
	Digital literacy	NEW	■	■	■
Data security	NEW		■	■	

Furniture assembler

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.



Furniture assembler

ISCO 8219s

2018 ▶▶

Occupational profile

Current profile description

Furniture assemblers place together all parts of furniture and auxiliary items such as furniture legs and cushions. They may also fit springs or special mechanisms. Furniture assemblers follow instructions or blueprints to assemble the furniture, and use hand tools and power tools.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Works in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial and technical services).
- Assists in the implementation of quality assurance activities.

Current profile tasks

- Reviewing work orders, specifications, diagrams and drawings to determine materials needed and assembly instructions.
- Fixed assembling with glue, screws, nails, fasteners and demountable assembling.
 - Finishing of the surfaces (filling up nail holes...)
 - Small corrections and reparations.
 - Mounting and adjusting fasteners and special hinges, rails...
- Reviewing work orders, specifications, diagrams and drawings to determine materials needed and assembly instructions.
- Recording production and operational data on specified forms.
- Inspecting and testing components and completed assemblies.
- Rejecting faulty products.

	McKinsey Levers											Industry 4.0 technologies							Forecast temporal horizon for change															
	Resource process	Asset utilization			Labor		Inventories	Quality		Supply/demand match	Time to market																							
	Smart energy consumption	Real-time yield optimization	Intelligent Lots	Routing flexibility	Machine flexibility	Remote monitoring and control	Predictive maintenance	Augmented reality for MRO	Human-robot collaboration	Remote monitoring and control	Automation of knowledge work	Digital performance management	Batch size 1	Real-time SC optimization	In situ 3D printing	Digital quality management	Statistical process control (SPC)	Advanced process control (APC)	Data-driven demand prediction	Data-driven design to value	Rapid experimentation and simulation	Customer co-creation/ open innovation	Concurrent engineering	Big data and analytics	Autonomous robots	Simulation	Horizontal and vertical system integration	The industrial internet of things	Cybersecurity	The cloud	Additive manufacturing	Augmented reality		
A	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
D	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	before 2025
E	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2025



2025

Occupational profile

Probability of technologies adoption in the following groups of companies				
A1	A2	B1	B2	
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)	
High	High	High	Medium	
High	High	High	Medium	
High	High	High	High	
High	High	High	Medium	
High	High	Medium	Light	

Description forecast of the occupational profile in 2025

Furniture assemblers place together all parts of furniture and auxiliary items such as furniture legs and cushions. They may also fit springs or special mechanisms. Furniture assembling is done by joint cooperation between robots and humans using cobots and sometimes it is significantly automated eventually into a fully autonomous process using cobots, big data and industrial IoT.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Use digitization tools to work in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial, ICT- and technical services).
- Assists in the implementation of quality assurance activities.

Profile tasks forecast

Semi-autonomous review of work orders jointly between humans and advanced artificial intelligence, based on computer vision, specifications, diagrams and drawings to determine materials needed and assembly instructions.

- Fixed assembling with glue, screws, nails, fasteners and demountable assembling
- Finishing of the surfaces (filling up nail holes...)
- Small corrections and reparations
- Mounting and adjusting fasteners and special hinges, rails...

Reviewing work orders, specifications, diagrams and drawings to determine materials needed and assembly instructions of the highly digitised enterprise ecosystem.

Recording production and operational data of the highly digitised manufacturing plant on specified digitized forms.

Inspecting and testing components and completed assemblies as integrated part of the fully digitised smart manufacturing ecosystem of the company.

Supervising the highly autonomous rejection system of faulty products.

Furniture assembler

ISCO 8219s

2018 ▶▶

Occupational profile

Current profile description

Furniture assemblers place together all parts of furniture and auxiliary items such as furniture legs and cushions. They may also fit springs or special mechanisms. Furniture assemblers follow instructions or blueprints to assemble the furniture, and use hand tools and power tools.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Works in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial and technical services).
- Assists in the implementation of quality assurance activities.

Current profile tasks

A	<p>Reviewing work orders, specifications, diagrams and drawings to determine materials needed and assembly instructions.</p> <ul style="list-style-type: none"> ▪ Fixed assembling with glue, screws, nails, fasteners and demountable assembling. ▪ Finishing of the surfaces (filling up nail holes...) ▪ Small corrections and reparations. ▪ Mounting and adjusting fasteners and special hinges, rails...
B	<p>Reviewing work orders, specifications, diagrams and drawings to determine materials needed and assembly instructions.</p>
C	<p>Recording production and operational data on specified forms.</p>
D	<p>Inspecting and testing components and completed assemblies.</p>
E	<p>Rejecting faulty products.</p>

New categorization of hazards

	Mechanical hazards	Unprotected moving parts ¹	Parts with hazardous shapes (cutting, pointed, rough)	Moving means of transport and tools ²	Uncontrolled moving parts (flying objects, wood chips)	Slip and trips	Falls from height	Ergonomic hazards	Heavy loads/heavy dynamic work	Awkward position/unbalanced strain	Repetitive movements	Lack of exercise, inactivity	Electrical hazards	Electric shock	Hazards due to physical effects/physical agents	Noise	Vibration	Laser light	Fire and explosion hazards	Flammable substances	Work environment hazards	Poor lighting conditions	Climate	Poor ventilation	Hazards through dangerous substances	Dust	Solvents (neurotoxic, allergens)	Carcinogens	New materials (e.g. Nanomaterials)	Psychosocial hazards	Excessive workloads
A		■	■		■	■					■	■				■	■	■		■			■			■	■	■		■	
B							■					■										■	■							■	
C												■										■	■							■	
D		■				■						■				■						■	■							■	
E		■				■						■				■						■	■							■	

■ No changes ■ New ones ■ Reduced

¹ Cobotics (Squeezing, bumping, crushing, cutting, amputation, drawing-in/trapping).
² Run over, roll over, falls from height.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile furniture assembler - ISCO 8219s



2025

Occupational profile

Description forecast of the occupational profile in 2025

Furniture assemblers place together all parts of furniture and auxiliary items such as furniture legs and cushions. They may also fit springs or special mechanisms. Furniture assembling is done by joint cooperation between robots and humans using cobots and sometimes it is significantly automated eventually into a fully autonomous process using cobots, big data and industrial IoT.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Use digitization tools to work in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial, ICT- and technical services).
- Assists in the implementation of quality assurance activities.

Low job satisfaction	Work tasks not clearly defined	Poor organisation of work	Poorly designed workplace environment (incl. software)	Repetitive, monotonous work	Cognitive strain	Stress due to long period concentration and awareness	Increased demands on flexibility	Lack of work experience	Lack of involvement in making decisions that affect the worker	Ineffective communication, lack of support from management or colleagues	Working alone/isolation	Workload: overload/underload
	■	■	■		■	■	■	■	■	■	■	■
	■	■	■		■	■	■	■		■	■	■
	■	■	■		■	■	■	■			■	■
	■	■	■		■	■	■	■			■	■
	■	■	■		■	■	■	■			■	■

Profile hazards forecast

A	Semi-autonomous review of work orders jointly between humans and advanced artificial intelligence, based on computer vision, specifications, diagrams and drawings to determine materials needed and assembly instructions. <ul style="list-style-type: none"> Fixed assembling with glue, screws, nails, fasteners and demountable assembling Finishing of the surfaces (filling up nail holes...) Small corrections and reparations Mounting and adjusting fasteners and special hinges, rails...
B	Reviewing work orders, specifications, diagrams and drawings to determine materials needed and assembly instructions of the highly digitised enterprise ecosystem.
C	Recording production and operational data of the highly digitised manufacturing plant on specified digitized forms.
D	Inspecting and testing components and completed assemblies as integrated part of the fully digitised smart manufacturing ecosystem of the company.
E	Supervising the highly autonomous rejection system of faulty products.

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work area Working on site, operate wood processing machines, use of hand and power tools to place together furniture and auxiliary items.</p>	<p>Work area Working on site, operate wood processing machines, use of hand and power tools, cobots and other digital machines to place together furniture and auxiliary items.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> ▪ Mechanical hazards from moving machines and tools. Machinery used to assemble furniture exposes workers to risks of being injured by unprotected moving parts, uncontrolled moving parts (air tools/electric staplers, springs) and parts with hazardous shapes (cutting, pointed, rough). Effects: severe bruises, cuts and sharp injuries. ▪ Slips and trips, obstacles, table edges. Effects: squeezing, cutting, twisting, spraining, bumps and bruises. 	<ul style="list-style-type: none"> ▪ Mechanical hazards from moving machines and tools. Machinery used to assemble furniture exposes workers to risks of being injured by unprotected moving parts, uncontrolled moving parts (air tools/electric staplers, springs) and parts with hazardous shapes (cutting, pointed, rough), and from cobots and robots. Effects: severe bruises, cuts and sharp injuries. Mechanical risks may decrease, depending on takeover of specific task by cobots/robots. ▪ Slips and trips, obstacles, table edges. Effects: squeezing, cutting, twisting, spraining, bumps and bruises.
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload. Effect: musculoskeletal diseases. 	<ul style="list-style-type: none"> ▪ Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload. Effect: musculoskeletal diseases. Risks from ergonomics hazards such as heavy load may decrease, depending on takeover of specific task by cobots/robots. On the other hand, workers may be increasingly exposed to ergonomic hazards such as lack of exercise/inactivity because of operating autonomous machines and cobots from computer workstations.
<p>Electrical hazards</p> <ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Electrical hazards from woodworking machines. Effect: fatal accident. 	<ul style="list-style-type: none"> ▪ Electrical hazards: contacts with live parts or connections or exposure to arc flash. Electrical hazards from woodworking machines and from autonomous or highly autonomous equipment. Effect: fatal accident.
<p>Hazards due to physical effects/physical agents</p> <ul style="list-style-type: none"> ▪ Noise Effects: hearing loss, headache, nervousness, poor concentration. ▪ Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease) 	<ul style="list-style-type: none"> ▪ Noise Effects: hearing loss, headache, nervousness, poor concentration. ▪ Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease) Exposure to noise and vibration may decrease, depending on takeover of specific tasks by cobots/robots. ▪ Laser: wood processing plant operators may be exposed to laser light. Effect: eye damage, negative effects similar to sunburn.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile furniture assembler - ISCO 8219s

2018 Current situation	2025 Situation forecast
<p>Fire and explosion hazards</p> <ul style="list-style-type: none"> Explosion and fire hazards from materials, including wood dust, solvents and chemicals. Effects: burns, fatal accidents. 	<ul style="list-style-type: none"> Explosion and fire hazards from materials, including wood dust, solvents and chemicals. Exposure to fire and explosion hazards may decrease, depending on takeover of specific tasks by cobots/robots. Effects: burns, fatal accidents.
<p>Work environmental hazards</p> <ul style="list-style-type: none"> Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation. Effect: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain. 	<ul style="list-style-type: none"> Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation. Effect: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.
<p>Hazards through dangerous substances</p> <ul style="list-style-type: none"> Chemical hazards: wood dust, solvents, preservatives, formaldehyde, glues, new substances/materials. Effects: contamination/intoxication, skin diseases, respiratory diseases, allergies, cancer. 	<ul style="list-style-type: none"> Chemical hazards: wood dust, solvents, preservatives, formaldehyde, glues, new substances/materials. Effects: contamination/intoxication, skin diseases, respiratory diseases, allergies, cancer. Chemical risks may decrease, depending on takeover of specific task by cobots/robots. New materials (e.g. nanomaterials): Nanotechnology and nanomaterials may be used in woods as well as wood-composite materials in order to improve some of their properties, e.g. to improve the water resistance or thermal conductivity. Effects: not yet well known, included are among others inflammation and tissue damage, fibrosis and tumour generation.
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility, repetitive and monotonous work. Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues. Working method: working with colleagues. Effects: stress, burnout 	<ul style="list-style-type: none"> Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility and digital know how, repetitive and monotonous work. Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues, lack of social contacts. Working method: working with colleagues, digital equipment, cognitive interactions with autonomous equipment. The use of cobots and other digital techniques may increase the risk of working alone and feeling isolated. Cognitive interactions between a robot and a human worker can lead to mental stress. Long period of concentration working with computer and new software and performing multitasking. Increased demand on flexibility as workers may perform some tasks from everywhere with mobile devices. Workers are also at risk of being permanent available outside working hours. Effects: stress, burnout

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile furniture assembler - ESCO 8219s

		Will it continue to be needed?	Main reasons of change		
			Furniture assembling is done by joint cooperation between robots and humans using cobots, big data and industrial IoT	Working in a highly digitized smart manufacturing ecosystem, with digitalized forms	Working as an integrated part of the fully digitized ecosystem of the company
Essential skills and competences	Align components	YES, changed	■		
	Apply a protective layer	YES			
	Assemble prefabricated furniture	YES, changed	■		
	Clean wood surface	YES			
	Create furniture frames	YES			
	Create smooth wood surface	YES			
	Ensure conformity to specifications	YES, changed		■	
	Follow written instructions	YES, changed	■	■	
	Join wood elements	YES, changed	■		
	Memorise assembly instructions	NO			
	Operate drilling equipment	YES, changed	■		
	Tend boring machine	YES, changed	■		
	Use power tools	YES, changed	■		
	Essential knowledge	Technical drawings	YES, changed		■
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	■	■	■
	Collaboration Across Networks and Leading by Influence	NEW	■		
	Agility and Adaptability	NEW	■	■	■
	Initiative and Entrepreneurship				
	Effective Oral and Written Communication	NEW		■	
	Assessing and Analyzing Information	NEW		■	
	Curiosity and Imagination	NEW	■	■	■
	Digital literacy	NEW	■	■	■
	Data security	NEW		■	■

Factory hand

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector digitization are in red colour.

Tasks changes

Current and forecasted tasks changes.

Hazards and risks changes

Current and forecasted risks changes.

Skills and competences needs

Forecast of training new needs.





2025

Occupational profile

Probability of technologies adoption in the following groups of companies				
A1	A2	B1	B2	
Early adopters with high abilities (investments and digital capacities, trained staff) to adopt all new technologies	Early adopters with high digital capacities, trained staff, but with limited capacities to adopt technologies requiring high investment	Companies with limited digital capacities, with intermediate trained staff (independent from company dimension) to adopt new technologies. Facility to learn and implement only technologies easy to adopt	Companies with low digital skills and low trained staff able to adopt only new essential technologies (independent from company dimension)	<p>Description forecast of the occupational profile in 2025 Factory hands assist machine operators and product assemblers. They clean the machines and the working areas. Factory hands make sure supplies and materials are replenished.</p> <ul style="list-style-type: none"> Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use Works in a customer-oriented manner Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence Contributes to continuous improvement of work processes in the company Coordinates work with the rest of the team, report to his/her team leader Cooperates with other departments (administrative, commercial, ICT and technical services) Assists in the implementation of quality assurance activities
				<p>Profile tasks forecast</p> <p>A Conveying goods, material, equipment and other items to highly digitized, connected and automated work areas, and removing finished pieces.</p> <p>B Digitally verifying specifications of goods, material, equipment and other items and checking the quality in order to ensure adherence to specifications.</p> <p>C Loading and unloading vehicles, trucks and trolleys in a digital manufacturing plant.</p> <p>D Clearing machine blockages, and cleaning machinery, equipment and tools when predictive maintenance and online realtime monitoring could not prevent this.</p> <p>E Carrying out semi-automated sorting of products or components when necessary in highly digitized factory.</p> <p>F Recording operational data of the digital factory on specified forms.</p>
High	High	High	Medium	
High	High	High	High	
High	High	High	Medium	
High	High	Medium	Light	
High	High	High	Medium	
High	High	High	High	

Factory hand

ISCO 9329

2018 ▶▶

Occupational profile

Current profile description

Factory hands assist machine operators and product assemblers. They clean the machines and the working areas. Factory hands make sure supplies and materials are replenished.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use.
- Works in a customer-oriented manner.
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence.
- Contributes to continuous improvement of work processes in the company.
- Coordinates work with the rest of the team, report to his/her team leader.
- Cooperates with other departments (administrative, commercial and technical services).
- Assists in the implementation of quality assurance activities.

Current profile tasks

	New categorization of hazards																															
	Mechanical hazards	Unprotected moving parts ¹	Parts with hazardous shapes (cutting, pointed, rough)	Moving means of transport and tools ²	Uncontrolled moving parts (flying objects, wood chips)	Slip and trips	Falls from height	Ergonomic hazards	Heavy loads/heavy dynamic work	Awkward position/unbalanced strain	Repetitive movements	Lack of exercise, inactivity	Electrical hazards	Electric shock	Hazards due to physical effects/physical agents	Noise	Vibration	Laser light	Fire and explosion hazards	Flammable substances	Work environment hazards	Poor lighting conditions	Climate	Poor ventilation	Hazards through dangerous substances	Dust	Solvents (neurotoxic, allergens)	Carcinogens	New materials (e.g. Nanomaterials)	Psychosocial hazards	Excessive workloads	
A	Conveying goods, material, equipment and other items to work areas, and removing finished pieces.	■	■	■		■			■	■	■					■	■					■	■	■		■	■	■	■	■	■	■
B	Cerifying specifications of goods, material, equipment and other items and checking the quality in order to ensure adherence to specifications.		■	■					■	■	■					■						■	■	■		■	■	■	■	■	■	■
C	Loading and unloading vehicles, trucks and trolleys.	■	■	■		■			■	■	■					■	■					■	■	■		■	■	■	■	■	■	■
D	Clearing machine blockages, and cleaning machinery, equipment and tools.	■	■	■		■			■	■	■		■		■	■						■	■	■		■	■	■	■	■	■	■
E	Carrying out manual sorting of products or components.	■	■			■			■	■	■	■			■							■	■			■	■	■	■	■	■	■
F	Recording operational data on specified forms.																					■	■								■	■

■ No changes ■ New ones ■ Reduced

¹ Cobotics (Squeezing, bumping, crushing, cutting, amputation, drawing-in/trapping).

² Run over, roll over, falls from height.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile factory hand - ISCO 9329



2025

Occupational profile

Low job satisfaction	Work tasks not clearly defined	Poor organisation of work	Poorly designed workplace environment (incl. software)	Repetitive, monotonous work	Cognitive strain	Stress due to long period concentration and awareness	Increased demands on flexibility	Lack of work experience	Lack of involvement in making decisions that affect the worker	Ineffective communication, lack of support from management or colleagues	Working alone/isolation	Workload: overload/underload
■	■	■	■	■			■	■	■	■		■
	■	■	■		■		■	■		■	■	■
■	■	■	■	■			■		■	■		■
■	■	■	■	■		■	■	■	■	■	■	■
■	■	■	■			■	■	■		■	■	■

Description forecast of the occupational profile in 2025

Factory hands assist machine operators and product assemblers. They clean the machines and the working areas. Factory hands make sure supplies and materials are replenished.

- Works in accordance with basic health and safety regulations, including environmental protection and efficient energy use
- Works in a customer-oriented manner
- Considers cost- and time-effectiveness when planning and organizing his/her work in his/her area of influence
- Contributes to continuous improvement of work processes in the company
- Coordinates work with the rest of the team, report to his/her team leader
- Cooperates with other departments (administrative, commercial, ICT and technical services)
- Assists in the implementation of quality assurance activities

Profile hazards forecast

	■	A	Conveying goods, material, equipment and other items to highly digitized, connected and automated work areas, and removing finished pieces.
	■	B	Digitally verifying specifications of goods, material, equipment and other items and checking the quality in order to ensure adherence to specifications.
	■	C	Loading and unloading vehicles, trucks and trolleys in a digital manufacturing plant.
	■	D	Clearing machine blockages, and cleaning machinery, equipment and tools when predictive maintenance and online realtime monitoring could not prevent this.
	■	E	Carrying out semi-automated sorting of products or components when necessary in highly digitized factory.
	■	F	Recording operational data of the digital factory on specified forms.

Comments on hazards and risks forecast

2018 Current situation	2025 Situation forecast
<p>Work area Working on site, cleaning and tidying up the workshop and machines, passing tools and materials, storage activities, supporting machine operators.</p>	<p>Work area Working on site, cleaning and tidying up the workshop and machines, passing tools and materials, storage activities, supporting machine operators using digitalized instruments.</p>
<p>Mechanical hazards</p> <ul style="list-style-type: none"> Mechanical hazards from moving machines and tools and means of transportation, uncontrolled moving parts and parts with dangerous shapes. Effects: severe bruises, amputations, cuts and sharp injuries, crushing, roll over or being crushed by means of transportation, forklift trucks etc. Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises. 	<ul style="list-style-type: none"> Mechanical hazards from moving machines and tools and means of transportation, uncontrolled moving parts and parts with dangerous shapes. Hazards from moving cobots/robots. Effects: severe bruises, amputations, cuts and sharp injuries, crushing, roll over or being crushed by means of transportation, forklift trucks etc. Risks may decrease with use of cobots/robots. Slips and trips, obstacles, table edges, moving vehicles, machines. Effects: squeezing, cutting, twisting, spraining, bumps and bruises.
<p>Ergonomic hazards</p> <ul style="list-style-type: none"> Ergonomic hazards: from poor ergonomic conditions, awkward position, confined spaces, handling heavy loads. Effect: musculoskeletal diseases. 	<ul style="list-style-type: none"> Ergonomic hazards: from poor ergonomic conditions, awkward position, confined spaces, handling heavy loads. Effect: musculoskeletal diseases. Risks may decrease with use of cobots/robots.
<p>Electrical hazards</p> <ul style="list-style-type: none"> Electrical hazards: caused by contact with defective or unearthed electrical equipment. Effect: fatal accident. 	<ul style="list-style-type: none"> Electrical hazards: caused by contact with defective or unearthed electrical equipment. Effect: fatal accident.
<p>Hazards due to physical effects/physical agents</p> <ul style="list-style-type: none"> Noise: sawmill, other wood processing machines. Effects: hearing loss, headache, nervousness, poor concentration. Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease). 	<ul style="list-style-type: none"> Noise: sawmill, other wood processing machines. Effects: hearing loss, headache, nervousness, poor concentration. Vibrations Effects: hand-arm-vibration syndrome (e.g. white finger disease). Exposure to noise and vibration risks may decrease, depending on takeover of specific task by cobots/robots.
<p>Fire and explosion hazards</p> <ul style="list-style-type: none"> Explosion and fire hazards from materials, including wood dust and chemicals. Effects: burns, fatal accidents. 	<ul style="list-style-type: none"> Explosion and fire hazards from materials, including wood dust and chemicals. Effects: burns, fatal accidents.
<p>Work environmental hazards</p> <ul style="list-style-type: none"> Work environmental hazards: excessive heat and cold, poor lighting. Effects: cardiovascular diseases, negative effects on muscles, tendons and joints, cold, poor concentration, eye strain. 	<ul style="list-style-type: none"> Work environmental hazards: excessive heat and cold, poor lighting. Effects: cardiovascular diseases, negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.

Hazards and risks changes

Current and forecasted risks changes due to sector digitization for the occupational profile factory hand - ISCO 9329

2018 Current situation	2025 Situation forecast
<p>Hazards through dangerous substances</p> <ul style="list-style-type: none"> ▪ Chemical hazards/dust: asbestos, glass fibre, vapours, fumes, dust, solvents. Effects: contamination/intoxication, skin diseases, respiratory diseases, cancer. Glues and solvents for assembling parts and finishing products. Injury of the eyes caused by splashing glue, cleaners, etc., burns caused by contact with hot glue/glue guns, allergies due to contact with formaldehyde and allergenic substances, exposure to dust. ▪ Biological hazards: bacteria, mould and fungi. Effects: contamination/intoxication, skin diseases, respiratory diseases, infections. 	<ul style="list-style-type: none"> ▪ Chemical hazards/dust: asbestos, glass fibre, vapours, fumes, dust, solvents. Effects: contamination/intoxication, skin diseases, respiratory diseases, cancer. Glues and solvents for assembling parts and finishing products. Injury of the eyes caused by splashing glue, cleaners, etc., burns caused by contact with hot glue/glue guns, allergies due to contact with formaldehyde and allergenic substances, exposure to dust. Risks may decrease with use of cobots/robots. ▪ New materials (e.g. nanomaterials): Nanotechnology and nanomaterials may be used in woods as well as wood-composite materials in order to improve some of their properties, e.g. to improve the water resistance or thermal conductivity. Effects: not yet well known, included are among others inflammation and tissue damage, fibrosis and tumour generation. ▪ Biological hazards: bacteria, mould and fungi. Effects: contamination/intoxication, skin diseases, respiratory diseases, infections. Risks may decrease with use of cobots/robots.
<p>Psychosocial hazards</p> <ul style="list-style-type: none"> ▪ Organisation of work: time pressure, shift work, stress, often related to poor work organisation, lack of experience and training, overload, low job satisfaction, repetitive, monotonous work. ▪ Social relationship: Lack of involvement in making decisions that affect the worker. ▪ Working method: unskilled work, working with colleagues. Effects: stress, burnout. 	<ul style="list-style-type: none"> ▪ Organisation of work: time pressure, shift work, stress, often related to poor work organisation, lack of experience and training, overload, low job satisfaction, repetitive, monotonous work, interactions between a robot and a human worker can lead to mental health risks. ▪ Social relationship: Lack of involvement in making decisions that affect the worker. Cobots/robots that replace colleagues may increase the risk of working alone and feeling isolated. ▪ Working method: unskilled work will change to digital know how. Long period of concentration working with computer and new software and performing multitasking. Increased demand on flexibility as workers may perform some tasks from everywhere with mobile devices. Workers are also at risk of being permanent available outside working hours. Effects: stress, burnout. <p>Robots/cobots may take over many tasks originally intended for factory hands, this may increase the feeling of being useless. On the other hand, operating more and more digitisation tools may change the task for factory hand totally and require new training and competences.</p>

Skills and competences needs

Forecast of training new needs due to sector digitization for the occupational profile factory hand - ESCO 9329

		Will it continue to be needed?	Main reasons of change	
			Working in highly digitized, connected and automated work areas	Step in situations where machines and automated processes block or temporarily fail
Essential skills and competences	Clean building floors	NO		
	Clean equipment	YES, changed	▪	▪
	Clean surfaces	NO		
	Maintain work area cleanliness	YES, changed	▪	▪
	Supply machine	YES, changed	▪	▪
	Supply machine with appropriate tools	YES, changed	▪	
	Wear appropriate protective gear	YES		
Essential knowledge	Cleaning products	NO		
	Cleaning techniques	YES, changed	▪	
	Industrial tools	YES, changed	▪	▪
NEW skills, knowledge and competences	Critical Thinking and Problem Solving	NEW	▪	▪
	Collaboration Across Networks and Leading by Influence			
	Agility and Adaptability	NEW	▪	▪
	Initiative and Entrepreneurship	NEW		▪
	Effective Oral - Written Communication			
	Assessing and Analyzing Information	NEW	▪	▪
	Curiosity and Imagination			
	Digital literacy	NEW	▪	▪
Data security	NEW	▪		