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Dopady dvojí transformace na nábytkářský průmysl EU

Prognóza pro odvětví do r. 2030 vzhledem k přechodu na cirkulární ekonomiku a digitální transformaci

CENFIM Furnishings Cluster
European Federation of Building and Woodworkers
EFBWW
EFIC European Furniture Industries Confederation
FLA FEDERLEGNOARREDO
UEA

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EFBWW

EFIC European Furniture Industries Confederation

FLA FEDERLEGNOARREDO

Partnerská organizace:

UEA

Spolupracující národní asociace:

apr

BRANCH CHAMBER OF WOODWORKING AND FURNITURE INDUSTRY

CBM

FCBA INSTITUT TECHNOLOGIQUE

FACKET FÖR SKOGS-, TRÄ- OCH GRAFISK BRANSCH

Poděkování

Chceme poděkovat našim kolegům, partnerům z projektu SAWYER: Chiara Terraneo, Nicolas Sangalli, Omar Degoli, Paolo Chini – Federlegno Arredo, Rolf Gehring – EFBWW, Gabriella Kemendi, Giorgia Murgia - EFIC a z naší partnerské organizace: David Pavlis – UEA. Poskytli důležité postřehy a odborné znalosti, jimiž inspirovaly náš výzkum a pomohli mu.

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Oceňujeme klíčové přispění našich externích odborníků: Juan Carlos Alonso (cirkulární ekonomika), Jeroen Doom (odborné vzdělávání a příprava, VET) a Ellen Schmitz-Felten (BOZP).

Chceme také poděkovat všem, kteří se podíleli na průzkumu SAWYER a zúčastnili se jeho seminářе. Svými rozmanitými multidisciplinárními příspěvky umožnili vznik rozsáhlé vize a prognózy pro nábytkářský průmysl na r. 2030 ve vztahu k oběhovému hospodářství a dvojí transformaci. Vedle výše zmíněných kolegů k nim patří: Alessandro Carzaniga, Alex Jimenez, Alexandra Canossa, Andreea Paraschiv, Anton Luiken, Antonella Ilaria Totaro, Arto Rajala, Bouke van den Wildenberg, Brigitte Döth, Carlo Proserpio, Chiara Catgiu, Emilie Bossanne, Erwan Mouazan, Francesc Castells, Francisco J. Campo, Frank O'Connor, Ger Brinks, Jan Leyssens, Jordi Oliver Solà, José María Fernández, Juan José Ortega Gras, Jude Sherry, Justyna Pensiek, Kees Hoogendijk, Kenneth Johansson, Kira Van den Ende, Marcel Van Meesche, Marco Fossi, Marta Escamilla, Marta Schuhmacher, Matthieu Leroy, Melody Van den Acker, Miroslava Simeonova, Nicola Cerantola, Nikolay Neykov, Nina Drejerska, Oriol Guimerà, Owain Griffiths, Patrica Lopez, Petar Antov, Pilar Chiva, Robert Babuka, Rubén Carnerero, Susanna Campogrande, Udo Kiel.

Rádi bychom poděkovali také národním nábytkářským asociacím, které vedle partnerů projektu připravily analýzu aktuálního přechodu tohoto průmyslu na cirkulární ekonomiku ve svých zemích:

- APMR – Rumunské sdružení výrobců nábytku / Rumunsko
- BBCWFI – Bulharská pobočka Komory dřevozpracujícího a nábytkářského průmyslu / Bulharsko
- CBM – Obchodní asociace pro stavby interiérů a nábytkářský průmysl / Nizozemsko
- FCBA – Technologický institut pro dřevařský a nábytkářský průmysl / Francie
- GS – Švédská unie lesnických, dřevařských a grafických pracovníků / Švédsko

Projekt SAWYER bylo možné uskutečnit pouze díky financování EK v rámci její výzvy k Předložení návrhů na podporu společenského dialogu, VP/2018/001.

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Přehled

Dvojí transformace (zelená a digitální) bude mít v příštích letech a desetiletích na nábytkářský průmysl EU ohromný vliv. Nová evropská průmyslová strategie, Zelená dohoda pro Evropu a nový Akční plán pro oběhové hospodářství budou hrát v transformaci průmyslu EU důležitou roli. Projekt SAWYER staví svou analýzu na výsledcích předchozího projektu DIGIT-FUR zaměřujícího se na vliv digitalizace na tento sektor v r. 2025. Klade si za cíl **zanalyzovat klíčové nástroje / faktory změn v přechodu** k **cirkulárnější ekonomice** v **nábytkářském průmyslu EU do r. 2030** a **předejmout pochopení těchto změn**. **Všem sociálním partnerům a zúčastněným stranám v sektoru** to poskytne užitečné informace o tom, jak tato transformace ovlivní jejich průmysl, jeho obchodní modely a pracovníky v celé délce jeho hodnotového řetězce do r. 2030.

Tento projekt byl implementován díky **mnoha partnerům (CENFIM, EFBWW, EFIC, FLA** a **UEA)** a národním subjektům (APMR, BBCWFI, CBM, FCBA a GS) s mnohaletými odbornými zkušenostmi v nábytkářském průmyslu. Po celou dobu jeho implementace poskytovali svou expertizu a postřehy i další **odborníci** na oběhové hospodářství, odborné vzdělávání a přípravu EU (VET), rizika v oblasti BOZP a na nábytkářský průmysl jako takový.

Projekt SAWYER byl zaveden podle **metodiky postupného výzkumu**. Z počátku byly zjištěny hlavní legislativní a dobrovolné nástroje a rovněž další politiky a strategie ovlivňující transformaci nábytkářského průmyslu EU směrem k cirkulárnější ekonomice. Na základě toho byl předpovězen vývoj 49 těchto nástrojů a zásad a jejich pravděpodobnost a dopad byl vyhodnocen pomocí **on-line průzkumu**, kterého se zúčastnilo 51 expertů z 15 zemí. Prognózy vývoje pak v **semináři** zanalyzovalo a doladilo 20 odborníků. Výsledky byly použity k prognóze scénáře pro nábytkářský průmysl EU na r. 2030 vzhledem k oběhovému hospodářství.

Tento scénář, jenž staví na výsledcích předchozího projektu DIGIT-FUR a přizpůsobuje nábytkářskému průmyslu **rámec ReSOLVE**, umožnil identifikovat **očekávané změny v jedenácti klíčových profesních profilech a jejich úkolech** následkem transformace průmyslu směrem k cirkulárnější ekonomice a digitalizaci. Odtud byla zjištěna nová **rizika v oblasti bezpečnosti a ochrany zdraví při práci** a změny v potřebných **dovednostech, znalostech a kompetencích**.

Všechny zprávy jsou k dispozici na:
circularfurniture-sawyer.eu/downloads

Hlavní výsledky výzkumu jsou dále shrnuty a začínají vizí projektu SAWYER:

Do r. 2030, s široce **digitalizovaným nábytkářským průmyslem**, bude výroba dřevěného nábytku nabízet **produkty a služby** s **designem ohleduplným vůči životnímu prostředí** založeným na **nízkém dopadu a vysledovatelných surovinách, udržitelných výrobních postupech**, podpoře **nejlepšího využití a scénářů obnovy** materiálů a vyřazených produktů. Zákazníci (B2B nebo B2C) budou vyžadovat podrobnější informace o výrobcích a jejich **udržitelných charakteristikách**, včetně ukazatelů jejich životního cyklu. Klíčem k úspěšnému dosahování cílů cirkulární ekonomiky bude posílení postavení spotřebitelů. Úřady (na místní, vnitrostátní a evropské úrovni) podpoří oběhovost **udržitelnými scénáři pro konec životnosti** materiálů a dřevěných výrobků rozšiřováním **státních a soukromých programů k zadávání zelených zakázek** a podporou **politik pro vyšší efektivitu materiálů**.

V tomto scénáři budou v sektoru hromadně používány **digitální nástroje**, a to jak malými a středními podniky, tak velkými firmami v celém jejich hodnotovém řetězci. Tyto digitální nástroje podpoří cirkulárnější ekonomiku, **zefektivní výrobní procesy** a usnadní **dohledatelnost** látek, materiálů a produktů. Zákazníci budou lépe informováni o **udržitelných vlastnostech** produktů a vzroste **elektronický obchod** s nábytkářskými výrobky, což změní marketingové činnosti a vztahy se zákazníky, obchod a související aspekty logistiky. Tento rámec umožní rostoucímu počtu výrobců nábytku zavést **v celém hodnotovém řetězci** různé praktiky cirkulární ekonomiky, díky čemuž budou jejich systémy řízení a výroby udržitelnější. Poroste společenská a legislativní poptávka po tom, aby společnosti snížily svou **ekologickou stopu** a přispívali k řešení současné změny klimatu. Cirkularita je v tomto průmyslu v raných fázích a bude patrná ve střednědobém a dlouhodobém horizontu.

Dvojí transformace nábytkářského průmyslu s sebou nese také **nové výzvy pro bezpečnost a ochranu zdraví při práci. Nové typy pracovišť, nové procesy, nové technologie** a **nové materiály/produkty** mohou ovlivnit bezpečnost a zdraví pracovníků. Nicméně pokud budou řádně naplánovány a používány, **zdraví a bezpečnost pracovníků lze jasně zlepšit**. Z tohoto důvodu musíme zajistit, aby tato transformace s novými technologiemi nebo pracovními postupy nevedla k novým rizikům. Pokud bude shodně dbáno na BOZP a ochranu životního prostředí, **cirkulární ekonomika by v tomto průmyslu měla být zavedena prostřednictvím bezpečnějších a efektivnějších strojních zařízení, pracovních procesů a materiálů**, které sníží chemická a fyzikální rizika pro pracovníky. Uplatňování **ekodesignu** u produktů by mělo usnadňovat jejich obnovu a opravy a snižovat ergonomická rizika. A rovněž snižovat obsah nebezpečných látek a redukovat tak v celém hodnotovém řetězci chemická rizika. Bezpečnost a zdraví pracovníků by se mohly zlepšit začleněním BOZP do systémů řízení kvality firem.

U některých profilů povolání budou vyžadovány **nové zelené dovednosti**, protože budou existovat nové, specifické úkoly související s demontáží a opětovným využitím, repasováním, recyklováním a upcyklací. Tyto nové dovednosti budou zvlášť důležité u úkolů „praktických" profilů povolání. Tyto nové zelené dovednosti budou mít také vliv, i když ne tak výrazný, na ty profily, které firmy řídí a provádějí v nich strategická rozhodnutí. **Obecné zelené dovednosti, znalosti a kompetence** byly navíc stanoveny jako nezbytné pro společenský, ekonomický a environmentální vývoj v dřevozpracujícím nábytkářském průmyslu. Jsou sladěny s klíčovými kompetencemi nebo měkkými dovednostmi (tzv. soft skills), které jsou uvedeny do kontextu environmentální informovanosti a pochopení udržitelného vývoje a cirkulární ekonomiky.

Výsledky projektu usnadní a podpoří společenský dialog mezi hlavními aktéry a zúčastněnými stranami v nábytkářském průmyslu, umožní jim řádně podporovat jeho dvojí transformaci, zvládnout problémy příštích let a **pracovníkům zajistit zaměstnatelnost a bezpečnost a firmám konkurenceschopnost**.

JÍT NA OBSAH

Úvod

Cíle

Celkovým záměrem projektu SAWYER bylo **pochopit a předpovědět**, jak nábytkářský průmysl EU ovlivní transformace **na oběhové hospodářství** a dále poskytnout užitečné postřehy **všem společenským partnerům a zainteresovaným stranám v tomto sektoru** o tom, jak průmysl, jeho obchodní modely a zaměstnance ovlivní tento přechod **v celém hodnotovém řetězci do r. 2030**. Během implementace projektu partneři viděli, že tato transformace k oběhovosti ekonomiky úzce souvisí s digitalizací odvětví, a rozhodli se postavit analýzu na již existujících výsledcích předchozího projektu DIGIT-FUR, který předpovídal dopad digitalizace na toto odvětví v r. 2025. Závěrem lze uvést, že nejdůležitějším výsledkem projektu SAWYER je prognóza **dopadu dvojí – zelené a digitální – transformace (tzv. Twin Transition) na nábytkářský průmysl EU**, a to obecně ve vztahu k jeho obchodním modelům, odbornému vzdělávání a přípravě, rizikům v oblasti BOZP a zvláště dopadu na jedenáct profilů povolání.

Tato prognóza dvojí transformace usnadní hlavním aktérům v tomto průmyslu **předcházet změnám** nutným k udržení a zlepšování kompetencí pracovníků, jejich bezpečnosti v práci a k zajištění konkurenceschopnosti firem v EU během následujících let i desetiletí.

Ke konkrétním cílům projektu SAWYER patřilo:

- Porozumět **aktuálnímu stavu a trendům** v nábytkářském průmyslu EU týkajících se legislativy pro cirkulární ekonomiku a dobrovolných nástrojů,
- Stanovit **pro tento sektor scénář na rok 2030** na základě jeho přechodu na oběhového hospodářství,
- Identifikovat **dopady** tohoto scénáře na **klíčové úkoly profesí v tomto odvětví, rizika v oblasti BOZP a potřebné dovednosti a znalosti,**
- Předpovědět**, co mohou zúčastněné skupiny v tomto průmyslu očekávat** v důsledku těchto změn a jak se s nimi vypořádat.
- Podporovat **evropský sociální dialog** a zlepšit vztahy v průmyslu EU,
- **Zmapovat úspěšné iniciativy** k podpoře zainteresovaných skupin v zavádění procesů cirkulární ekonomiky.

Metodika

Metodiku výzkumu přijatou partnery (Obr. 1) navrhl tým CENFIM SAWYER (M. Rumignani, J. Rodrigo, J. Solana) a externí odborník na cirkulární ekonomiku Juan Carlos Alonso. Byla zavedena za podpory dalších partnerů projektu SAWYER (FLA, EFBWW, EFIC a UEA) a dalších dvou externích odborníku, Jeroena Dooma (systém odborného vzdělávání a přípravy VET) a Ellen Schmitz-Felten (rizika v oblasti BOZP). Z počátku studie byly zjištěny **hlavní legislativní a dobrovolné nástroje a další politiky a strategie**, jež mohou ovlivnit transformaci nábytkářského průmyslu EU směrem k cirkulárnější ekonomice.

Obr. 1. Schéma metodiky projektu

K podpoře této analýzy byla připravena konkrétní zpráva o **současném stavu těchto nástrojů a politik** na evropské úrovni a v sedmi státech EU (Španělsku, Itálii, Francii, Nizozemsku, Rumunsku, Bulharsku a Švédsku). Na základě toho byl předpovězen vývoj 49 těchto nástrojů a politik a jejich pravděpodobnost a dopad byly ohodnoceny pomocí **on-line průzkumu**, kterého se zúčastnilo 50 evropských expertů na cirkulární ekonomiku a/nebo nábytkářský průmysl z 15 členských států EU.

Po získání, zpracování a souhrnu bylo těchto 49 prognóz vývoje zanalyzováno a vyladěno v **semináři** , jehož se zúčastnilo 20 odborníků z 9 členských zemí EU s různou expertizou – se znalostmi nábytkářského průmyslu, ekodesignu a specifické legislativy pro cirkulární ekonomiku a dobrovolných nástrojů. Konečným výsledkem tohoto procesu byla **zpráva „Prognóza scénáře pro nábytkářský průmysl ve vztahu k cirkulární ekonomice na r. 2030“**. Předpovídá stav tohoto průmyslu v EU v r. 2030 na základě prognózy předchozího projektu DIGIT-FUR na r. 2025, jenž analyzoval dopad digitalizace na tento sektor. Výsledkem je prognóza a analýza dopadu **dvojí transformace (zelené a digitální)** na evropský nábytkářský průmysl na příští léta a dekády.

Na základě těchto výsledků a výsledků projektu DIGIT-FUR identifikoval odborník projektu na cirkulární ekonomiku ve spolupráci s projektovým týmem CENFIM SAWYER **očekávané změny v úkolech jedenácti hlavních profesních profilů** následkem přerodu sektoru směrem k cirkulárnější ekonomice a digitalizaci. Byla implementována analýza přizpůsobená na **rámec ReSOLVE** nábytkářského průmyslu vytvořená střediskem McKinsey Center a nadací Ellen MacArthur Foundation. Nové tabulky prognózy tedy obsahují očekávané výsledky dvojí transformace (zelené a digitální) nábytkářského průmyslu a poskytují jasný obraz očekávaných budoucích úkolů všech jedenácti profilů povolání.

Dalším krokem byla analýza současných rizik a očekávaných **změn v rizicích a nebezpečích v oblasti BOZP** v důsledku digitalizace sektoru a přechodu na cirkulární ekonomiku, přičemž bylo bráno v potaz přeformulování úkolů pro jednotlivé profesní profily z předchozí analýzy. V této analýze byly stanoveny jiné typy nebezpečí, jimž mohou čelit pracovníci v dřevozpracujících výrobních závodech v různých kategoriích rizik.

JÍT NA OBSAH

Posledním krokem byla analýza možných změn u **potřebných znalostí, dovedností a kompetencí (ZDK)** následkem digitalizace odvětví (do r. 2025) a cirkulární ekonomiky (do r. 2030) u jedenácti klíčových profesních profilů. Byly přitom zjišťovány „hlavní důvody a příčiny změn" u digitalizace a oběhového hospodářství a analyzováno, zda budou tyto ZDK potřebné i nadále. Tato analýza umožňuje zjistit, jaké ZDK se změní a jaké nové kompetence pro cirkulární ekonomiku budou v tomto průmyslu vyžadovat podniky ochotné se přizpůsobit a řádně využít možností nabízených rostoucí cirkularitou odvětví.

Na základě další analýzy a zpracování všech výsledků vytvořili odborníci a partneři projektu SAWYER sadu **doporučení** pro zúčastněné strany v nábytkářském průmyslu obecně a konkrétně pro tvůrce politik, poskytovatele odborného vzdělání a přípravy a regulační orgány.

Cvičení ke zmapování **evropských iniciativ** usnadňujících a podporujících transformaci průmyslových odvětví EU směrem k cirkulárnější ekonomice nám dodalo informace o různých důležitých vnitrostátních a regionálních iniciativách.

Zanalyzovali jsme 11 klíčových profilů povolání vybraných z klasifikace ESCO (Evropská klasifikace dovedností/kompetencí, kvalifikací a povolání) se souvisejícím identifikačním kódem ISCO (Mezinárodní standardní klasifikace zaměstnání):

1221 Vedoucí a řídící pracovníci v oblasti prodeje a marketingu
1321s Vedoucí průmyslové výroby
1324s Manažer dodavatelského řetězce (manažer dodávek, manažer distribuce a podobní)
2141s Inženýři údržby a oprav (pracovnici strojni udržby a opravaři)
2163s Nábytkoví návrháři (designéři průmyslových a textilních výrobků)
7522 Truhláři (kromě stavebních) a pracovníci v příbuzných oborech
7523 Seřizovači a obsluha dřevoobráběcích strojů
7534 Čalouníci a pracovníci v příbuzných oborech
8172 Obsluha strojů a zařízení na zpracování dřeva
8219s Montážní dělníci nábytku
9329 Pomocní pracovníci

Výsledky

Současný stav cirkulární ekonomiky v nábytkářském průmyslu EU

Analýza projektu SAWYER pokryla nábytkářský průmysl, který má podle klasifikace NACE verze 2 kód 31.0 (Výroba nábytku). Má tržby 110,4 miliard eur a přidanou hodnotu 32 % (podle nejnovějších údajů EUROSTATu z r. 2018), díky čemuž jde o velmi důležité odvětví hospodářství EU a také proto, že zaměstnává 1 043 806 pracovníků (EUROSTAT, 2018). Nábytkářský průmysl ve 28 státech EU se povětšinou skládá z mikropodniků a malých a středních firem, jak ukazuje tabulka níže.

V následující tabulce jsou uvedeny údaje pracovníků v souvislosti s hlavními kategoriemi pracovních funkcí a profilů analyzovaných projektem SAWYER.

Tabulka 1. Počet pracovníků v hlavních kategoriích nábytkářského průmyslu EU v r. 2018

Kategorie pracovních funkcí[1]	Přibližný počet v r. 2018, 1 043 806 pracovníků[2]	Profesní profily, na něž se zaměřoval projekt SAWYER (profily povolání dle ISCO)
Manažeři	80 395	V této studii nesledováni
Odborníci na ICT	11 485	V této studii nesledováni
Návrháři	10 818	2163s Nábytkoví návrháři
Produktoví manažeři	22 970	1321s Vedoucí průmyslové výroby
Pracovníci v oblasti prodeje a marketingu	22 970	1221 Vedoucí a řídící pracovníci v oblasti prodeje a marketingu + další profily nesledované v této studii
Manažeři dodavatelského řetězce	10 818	1324s Manažer dodavatelského řetězce
Podpůrní administrativní pracovníci	114 851	V této studii nesledováni
Pracovníci údržby závodu, strojní údržby a oprav	68 910	2141s Inženýr údržby a oprav + další profily v této studii nesledované
Kvalifikovaní řemeslní pracovníci (truhláři a čalouníci)	574 255	7522 Truhláři (kromě stavebních) a pracovníci v příbuzných oborech
		7534 Čalouníci a pracovníci v příbuzných oborech
		8219s Montážní dělníci nábytku
Strojní operátoři	45 941	7523 Seřizovači a obsluha dřevoobráběcích strojů
		8172 Obsluha strojů a zařízení na zpracování dřeva
Dělníci	80 395	9329 Pomocní pracovníci

[1]Kategorie pracovních funkcí ze studie TNO, ZSI, SEOR (2009), EK.
[2]Založeno na údajích EUROSTATu o celkovém počtu pracovníků v nábytkářském průmyslu 28 států EU.

Po zjištění **hlavních legislativních a dobrovolných nástrojů** a dalších **politik** a strategií ovlivňujících transformaci nábytkářského průmyslu EU **směrem k cirkulárnější ekonomice** byla zavedena podrobnější analýza jejich využití.

V první zprávě projektu „Současný stav cirkulární ekonomiky v nábytkářském průmyslu" vypracované v listopadu 2019 vytvořili partneři podrobnou analýzu všech těchto prvků a stupeň jejich zavedení jak v EU, tak konkrétně v některých jejích zemích (Francie, Itálie, Španělsko, Rumunsko, Nizozemsko, Švédsko, Bulharsko). Tyto související poznatky považují partneři za nezbytné, aby byla cirkulární ekonomika v sektoru řádně pochopena a bylo možné předpovědět její vývoj.

Vybrané nástroje byly seskupeny do tří různých skupin: legislativní nástroje, dobrovolné nástroje a další politiky a strategie. Jejich podrobný popis a výsledky jejich analýzy byly uvedeny ve třech různých dokumentech:

- Současný stav cirkulární ekonomiky v nábytkářském průmyslu v EU
- Současný stav cirkulární ekonomiky v nábytkářské průmyslu 7 zemích EU
- Souhrnná tabulka: Aktualizace současného stavu cirkulární ekonomiky v nábytkářském průmyslu EU

Všechny tyto dokumenty lze stáhnout z webových stránek projektu SAWYER: circularfurniture-sawyer.eu/downloads

Následující tabulka představuje seznam vybraných nástrojů a politik a jejich odhadovaný stupeň zavedení v EU, na stupnici od 1 do 5 (kdy 1 = nejnižší hodnota, 5 = nejvyšší hodnota).

Tabulka 2. Seznam vybraných nástrojů a politik a stupeň jejich zavedení v EU

Nástroj	Popis	Stupeň zavedení
Legislativní nástroje		
Balík opatření EK pro cirkulární ekonomiku	Akční plán pro oběhové hospodářství (COM (2015) 614) má za cíl podpořit zavádění cirkulární ekonomiky v Evropě. Obsahuje revizi některých předpisů (např. rámce pro odpady) a další opatření na podporu cirkulárního charakteru ekonomiky (např. strategie pro plasty).	**5** Všech 54 navržených akcí bylo dokončeno nebo jsou ve fázi implementace {SWD(2019) 90 v konečném znění}.
Zelená dohoda pro Evropu	Zelená dohoda pro Evropu (COM(2019) 640 v konečném znění a příloha) je plán EU na vytvoření udržitelnějšího hospodářství s opatřeními, která: • podpoří efektivní využívání zdrojů přesunem k čistší, cirkulárnější ekonomice, • obnoví biodiverzitu a sníží znečištění. • Cílem je, aby se EU stala klimaticky neutrální do r. 2050 a tento přechod byl pro všechny spravedlivý a inkluzivní. Bude to od všech hospodářských odvětví EU vyžadovat akční jednání včetně: • investování do technologií ohleduplných k životnímu prostředí, • podpory inovací v průmyslu, • zavedení čistších, levnějších a zdravějších forem soukromé a veřejné dopravy, • dekarbonizace energetiky, • zajištění vyšší energetické efektivity budov, • práce s mezinárodními partnery na zlepšování globálních environmentálních norem.	**2** V tomto bodě 2.1.3. týkající se mobilizace průmyslu pro čistou a cirkulární ekonomiku je oznámeno, že Komise přijme průmyslovou strategii EU a zveřejní nový Akční plán pro oběhové hospodářství jakožto pilíře této Zelené dohody pro Evropu (uskutečněno v březnu 2020). V příloze sdělení o Zelené dohodě pro Evropu je stanoven plán a hlavní akce, od r. 2019 do r. 2021. Tyto hlavní akce jsou roztříděny podle následujících témat: • Cíle týkající se klimatu • Čistá, cenově dostupná a bezpečná energie • Průmyslová strategie pro čistou a cirkulární ekonomiku • Udržitelná a chytrá mobilita • „Zezelenání" společné zemědělské politiky / strategie „Z farmy na vidličku" • Zachování a ochrana biodiverzity • Směřování k nulovému znečištění pro životní prostředí bez toxických látek • Začleňování udržitelnosti do všech politik EU • EU jako globální lídr • Spolupráce – Evropský klimatický pakt
Nový Akční plán pro oběhové hospodářství pro čistší a konkurenceschopnější Evropu	Nový Akční plán pro oběhové hospodářství (COM(2020) 98 v konečném znění a příloha) ohlašuje iniciativy během celého životního cyklu produktů a cílí například na jejich design; podporuje postupy cirkulární ekonomiky a udržitelnou spotřebu a zaměřuje se na to, aby využívané zdroje zůstaly v hospodářství EU co nejdéle.	**1** Tento plán uvádí ve své příloze časový rozvrh pro navržené iniciativy, od r. 2020 do r. 2023. Tyto hlavní akce jsou roztříděny podle následujících témat: • Rámec politiky pro udržitelné produkty • Hlavní hodnotové řetězce produktů • Méně odpadu, více hodnoty • Funkční oběhovost pro lidi, regiony a města • Průřezové akce • Přední snahy na globální úrovni • Pokroky v monitorování
Směrnice o odpadních elektrických a elektronických zařízeních (OEEZ)	Směrnice 2012/19/EU požaduje vytvořit programy pro sběr (pro spotřebitele bezplatný) zařízení ke zvýšení opětovného využití OEEZ a/nebo k recyklaci.	**5** Předchozí směrnice o OEEZ vstoupila v platnost v r. 2003. V r. 2017 přijala Komise „Balík opatření o OEEZ" a v r. 2018 konečnou zprávu o podpoře dodržování předpisů OEEZ, přičemž prošetřovala jejich zavedení v jednotlivých zemích EU.
Omezení používání nebezpečných látek v elektrických a elektronických zařízeních (ROHS)	Směrnice 2011/65/EU byla pozměněna směrnicí (EU) 2017/2102, kdy byl zrevidován její rozsah pro některé skupiny produktů a bylo vyzváno k podpoře cirkulárnější ekonomiky v Unii prostřednictvím operací na sekundárním trhu s EEZ, který zahrnuje opravy, výměnu náhradních dílů, repasování, opětovné využití a dovybavení.	**5** Předchozí směrnice ROHS vstoupila v platnost v r. 2003. Několikrát byla zrevidována, přičemž se měnily výjimky a jejich termíny.
Směrnice o energetických spotřebičích (směrnice o ekodesignu)	Směrnice 2009/125/ES stanoví rámec pro určení požadavků na ekodesign výrobků spojených se spotřebou energie (tj. nemusí spotřebovávat energii přímo, ale mohou vést k její dodatečné spotřebě, například okna).	**4** EK zveřejňuje pracovní plány ke zjišťování prioritních skupin produktů a budoucích strategií. Nejnovější pracovní plán pokrývá období 2016–2019 a věnuje více pozornosti efektivnímu využívání zdrojů, analýze možného uplatnění dodatečných požadavků konkrétně podle produktu, například u trvanlivosti atd.
Rozšířená odpovědnost výrobce (EPR)	Rozšířená odpovědnost výrobce (EPR) je „přístup environmentální politiky, v níž odpovědnost výrobce za produkt v jeho životním cyklu zahrnuje i fázi po jeho spotřebě".	**4** Stávající směrnice na úrovni EU pro některé konkrétní výrobky (OEEZ, baterie, vozidla na konci svého životního cyklu, obaly atd.), na vnitrostátní úrovni pak programy EPR pro další produkty.

Nástroj	Popis	Stupeň zavedení
Nebezpečné látky / nařízení REACH	Cílem nařízení REACH (ES 1907/2006) je zlepšení lidského zdraví a ochrany životního prostředí identifikací nebezpečných vlastností chemických látek v EU. Jak výrobci, tak dovozci jsou povinni získávat informace o konkrétních a důležitých vlastnostech chemických látek, které používají.	**3** REACH je plně operativní, ale za původním očekáváním zůstává pozadu. Ke zjištěným problémům patří mimo jiné nedostatek vyhovujících informací v registračních svazcích nebo potřeba zjednodušit povolovací proces.
Formaldehydové emise	Formaldehyd vytvořený a importovaný na evropské úrovni se využívá hlavně k výrobě pryskyřic používaných na výrobu dřevěných desek. Expozice formaldehydovým emisím je důležité téma pro spotřebitele (emise ze zboží) a pro pracovníky (expozice při práci).	**2** Na evropské úrovni neexistuje společný legislativní požadavek, ale v průmyslu existuje dobrovolná dohoda členů Evropské federace výrobců desek (EPF), která vyrábí dřevěné desky pouze třídy E1. Některé členské státy EU přijaly vnitrostátní zákony. V EU současný koncentrační limit hodnota pro pracoviště je 0,3 mg / m³.
Pravidla EU ohledně kritérií pro konec životního cyklu odpadů	Směrnice 2008/98/ES o odpadech uvádí, že některý specifický odpad by neměl být považován za normální odpad, pokud projde procesem obnovy (včetně recyklace) a splňuje konkrétní kritéria vytvořená v souladu s určitými právními podmínkami. Cílem je odstranit administrativní zátěž legislativy o odpadech u bezpečných a vysoce kvalitních odpadových materiálů k usnadnění jejich recyklace.	**3** Na evropské úrovni byla stanovena kritéria pro 8 typů odpadů, existují ale specifická nařízení pro železný, ocelový, měděný a hliníkový šrot a skleněné střepy.
Látky zpomalující hoření	U některých nábytkářských výrobků se používají látky zpomalující hoření ke splnění různých norem hořlavosti pro nábytek. Některé z těchto norem vyžadují splnění zkoušek reakce na oheň za nuceného použití látek zpomalujících hoření. Některé druhy látek používané ke zpomalování hoření jsou regulované nařízením (EU) 2019/1021, které je přepracovaným zněním nařízení (ES) 850/2004 o perzistentních organických znečišťujících látkách (POPs).	**3** Používání látek zpomalujících hoření není na evropské úrovni přímo regulováno. Je regulováno nepřímo v případech, kdy jsou použité látky považovány za nebezpečné (tj. prostřednictvím nařízení REACH nebo POPs). Uvedená nařízení jsou dobře zavedená a studují se nové látky.
Směrnice o obnovitelné energii (RED II)	V prosinci 2018 vstoupila v platnost zrevidovaná směrnice 2018/2001/EU o podpoře využívání energie z obnovitelných zdrojů jako součást balíku opatření Čistá energie pro všechny Evropany. Stanovila pro obnovitelnou energii v EU nový závazný cíl nejméně 32 % do r. 2030, s klauzulí o možné revizi s možným zvýšením do r. 2023. Směrnice o obnovitelné energii stanoví kritéria udržitelnosti pro všechna biopaliva vyráběná nebo spotřebovávaná v EU.	**4** Směrnice je zavedena a pro obnovitelnou energii se zvažují ambicióznější cíle. Ohledně udržitelnosti biopaliv mohou podniky ukázat, že splňují kritéria udržitelnosti přes národní systémy nebo tzv. dobrovolné programy uznané Evropskou komisí.
Nelegální těžba dřeva a nelegální obchod se dřevem	Nařízení (EU) č. 995/2010 definuje povinnosti hospodářských subjektů prodávajících nebo uvádějících dřevo a dřevařské výrobky na trh. Je známé jako nařízení EU o dřevě (EUTR) a je součástí Akčního plánu EU pro vymahatelnost práva, správu a obchod v lesnictví (FLEGT). Dalším programem je Úmluva o mezinárodním obchodu s ohroženými druhy volně žijících živočichů a planě rostoucích rostlin (CITES).	**5** Tato nařízení a akční plány jsou zavedeny na úrovni EU i na mezinárodní úrovni. Zveřejňují se nové akční plány na ochranu lesů, například COM(2019) 352 v konečném znění o „Urychlení jednání EU na ochranu a obnovu světových lesů", s návrhem na zřízení observatoře EU pro sledování odlesňování a znehodnocování lesů.
Dobrovolné nástroje		
Zadávání zelených veřejných zakázek (GPP)	Zadávání zelených veřejných zakázek začleňuje do specifikací veřejné soutěže kritéria ochrany životního prostředí, včetně integrace environmentálních složek do rozhodnutí o veřejných zakázkách. Tato environmentální kritéria by mohla pokrývat různé aspekty výrobků během jejich životního cyklu. GPP může pomoci vytvořit vysokou poptávku po udržitelnějším zboží a službách, které by jinak nebylo snadné na trhu dosáhnout.	**3** Stupeň skutečné implementace se v každém státě EU liší. Evropská komise a několik zemí EU připravily pro postupy GPP různé pokyny, ve formě vnitrostátních kritérií pro GPP. Hlavní výzvou je zajistit kompatibilní požadavky na GPP v jednotlivých zemích EU a postarat se o to, aby tato kritéria přijímalo více úřadů veřejné správy.
Environmentální management ve společnostech	Systém environmentálního managementu (EMS) může společnostem pomoci v identifikaci, řízení, monitorování a kontrole jejich environmentálních aspektů „holistickým" způsobem. Na evropské úrovni existují dva hlavní certifikované Systémy environmentálního managementu, EMAS a ISO-14001:2015.	**4** Byly publikovány různé revize programů ISO a EMAS. Jedná se o konsolidované programy, v obchodním sektoru však zavedené jen částečně. Na úrovni EU má certifikaci EMAS 3728 společností (duben 2019) a 111 133 jich má certifikaci ISO-14001 (2017).

Nástroj	Popis	Stupeň zavedení
Metodika ekodesignu	Ekodesign je definován jako „integrace environmentálních hledisek do návrhu výrobku a vývoj s cílem snižovat nepříznivé dopady na životní prostředí po celou dobu životního cyklu produktu". Pokyny napomáhající organizacím při vytváření, dokumentování, implementování, udržování a neustálém zlepšování jejich řízení ekodesignu jako součásti systému environmentálního managementu poskytuje norma ČSN-EN ISO 14006:2020. K ekodesignu se pojí i jiné normy, jako UNE-ISO/ TR 14062:2007 nebo IEC 62430:2019.	**3** Nejnovější revize normy ISO 14006 je z r. 2020. Tato norma uvádí, že není určena k certifikačním účelům, je tedy obtížné znát skutečný stupeň jejího zavedení na trhu. V každém případě se její implementace považuje za mnohem nižší než u ISO-14001.
Ekoznačky (typ I, II a III)	Snahou ekoznaček je informovat zákazníky o environmentálních vlastnostech výrobku. Existuje ohromné množství různých ekoznaček, ale všechny lze zahrnout do tří hlavních typů (tj. I, II a III); jsou regulovány normou ISO 14020.	**4** Různé systémy ekoznaček jsou dobře vyvinuté a široce používané u některých typů výrobků (např. u spotřebních produktů). Je však třeba dál pracovat na lepším informování spotřebitelů o jejich skutečném významu a vyhnout se tak nedorozumění.
Certifikace zpracovatelského řetězce (FSC/PEFC)	Certifikace zpracovatelského řetězce pro dodávky dřeva prokazuje, že certifikovaný výrobek pochází z certifikovaných, řádně spravovaných lesů. Ověřuje a zajišťuje, že tyto produkty nejsou v dodavatelském řetězci nikdy míchány s jinými výrobky z necertifikovaných lesů, kromě případů přísných kontrol, kdy je užíváno značení s jejich procentem (%). V současné době působí v dřevařském průmyslu dva nezávislé akreditované programy pro zpracovatelské řetězce: FSC (Forest Stewardship Council) a PEFC (Programme for the Endorsement of Forest Certification).	**5** Tyto dva programy jsou dobře rozvinuté a poptávka po certifikaci zpracovatelského řetězce se v posledních třech letech výrazně zvýšila, do té míry, že pro mnoho podniků je schopnost prokázat, že dřevařský výrobek pochází z řádně spravovaného zdroje, klíčovým faktorem v označování dřevařských a papírových produktů.
Certifikace zelených budov (BREEAM / LEED)	Existují dva hlavní certifikační programy pro budovy šetrné k životnímu prostředí: BREEAM (Building Research Establishment's Environmental Assessment Method), což byl první systém hodnocení zelených budov ve Velké Británii, a LEED (Leadership in Energy and Environmental Design) nedávno vytvořený v USA radou Green Building Council (USGBC).	**4** Tyto dva programy jsou na úrovni EU dobře zavedené. Prostřednictvím BREEAM je například certifikováno 19 542 odhadů v zemích EU (většina z nich ve Velké Británii) a certifikací LEED 3766 projektů. Poptávka po tomto typu certifikace roste, ale nadále se jedná o malou část celého sektoru výstavby.
Další nástroje a politiky		
Kaskádové využívání dřeva	Kaskádové využívání zdrojů biomasy, jako dřeva a zemědělských produktů, znamená efektivní používání těchto zdrojů z hlediska spotřeby přírodních zdrojů, materiálů a půdy. Dává přednost využití s vyšší hodnotou umožňujícímu opětovné použití a recyklaci produktů a surovin. Podporuje přitom používání energie, pouze pokud nejsou jiné možnosti.	**2** Evropská komise zveřejnila na toto téma dvě důležité publikace včetně Průvodce o kaskádovém využívání biomasy. S tímto tématem nesouvisí do dnešního dne žádné další požadavky.
Průmyslová politika EU pro lesnictví	Evropská komise přijala Strategii EU v oblasti lesnictví v r. 2013 (COM(2013) 659 v konečném znění), jejímž cílem je pomoci lesům a souvisejícímu odvětví vyřešit současné problémy. Strategie poskytuje rámec k reagování na rostoucí požadavky kladené na lesy a ke zvládnutí společenských a politických změn. Strategie EU v oblasti lesnictví 2014–2020 byla vytvořena k poskytnutí koherentního rámce jak pro politiky EU související s lesy, tak pro vnitrostátní politiky jednotlivých členských států týkající se lesnictví.	**4** V r. 2018 předložila Komise zprávu „Pokrok v implementaci strategie EU v oblasti lesnictví" (COM(2018) 811 v konečném znění) s revizí této strategie. Tato revize zdůrazňuje, že strategie EU pro lesnictví dosahuje svých cílů ohledně podpory udržitelnějšího řízení lesů na úrovni EU a globální úrovni.
Návrh pro průmyslová odvětví založená na lesnictví	V r. 2013 zveřejnila Evropská komise Návrh pro průmyslová odvětví EU založená na lesnictví (SWD(2013) 343 v konečném znění). Tento dokument doprovázel strategii EU v oblasti lesnictví a zdůrazňuje výzvy, jimž musí průmyslová odvětví založená na lesnictví čelit, aby zůstala konkurenceschopná.	**3** Byla identifikována některá opatření k řešení těchto výzev na léta 2014–2020. Skupina organizací předložila pro průmyslová odvětví založená na lesnictví společnou strategickou vizi a program na r. 2050.
Bioekonomika	Cílem bioekonomiky je inovativnější ekonomika s nižšími emisemi začleňující požadavky na udržitelné zemědělství a rybolov, bezpečnost potravin a udržitelné využívání obnovitelných biologických zdrojů pro průmyslové účely, která zajišťuje biodiverzitu a ochranu životního prostředí.	**3** Evropská komise stanovila Strategii pro bioekonomiku a akční plán zveřejněný v r. 2012 a zrevidovaný v r. 2018. V této aktualizaci byl navržen akční plán se 14 konkrétními opatřeními k zahájení v r. 2019. Navíc Komise pracuje na zajištění koherentního přístupu k bioekonomice prostřednictvím různých programů a nástrojů (např. Horizon 2020, BBI atd.).

Prognóza: výsledky průzkumu a semináře

Následnými kroky v projektu byla organizace **online průzkumu k vytvoření prognózy a seminář s odborníky**. Průzkumu se zúčastnilo 50 profesionálů z 15 zemí EU a podpořila ho předem připravená zpráva o současném stavu. Odborníci na cirkulární ekonomiku a/nebo nábytkářský průmysl měli zhodnotit pravděpodobnost a dopad 49 prognóz vývoje očekávaných do r. 2030 a souvisejících s předem zjištěnými nástroji a politikami.

K cílům průzkumu patřilo:

- Identifikace **nejpravděpodobnějších prognóz vývoje** do r. **2030**.
- Vytvoření **prvního konceptu soupisu situací, které tento sektor do r. 2030 ovlivní nejvíce**.

Výsledky průzkumu umožnily seřadit těchto 49 prognóz vývoje podle jejich **pravděpodobnosti** a důležitosti **dopadu** transformace k cirkulárnější ekonomice na odvětví a ukázat zúčastněným stranám, kterým z těchto nástrojů by měly věnovat více pozornosti, aby řádně zvládly výzvy přechodu na oběhovému hospodářství.

Po získání, zpracování a souhrnu byly zanalyzovány a prodebatovány ve specifickém semináři v prosinci 2019, jehož se zúčastnilo 20 odborníků z 9 členských zemí EU s různou expertizou, od znalostí nábytkářského průmyslu přes ekodesign až po specifickou legislativu pro cirkulární ekonomiku. Společný brainstorming a postřehy expertů pomohly aktualizovat a doladit 49 prognóz vývoje a zlepšit předpověď vývoje tohoto průmyslu do r. 2030.

Konečným výsledkem těchto postupů byla zpráva **„Prognóza scénáře pro nábytkářský průmysl ve vztahu k cirkulární ekonomice v r. 2030"**. Obsahuje scénář předpovědi ohledně dopadu transformace k cirkulárnější ekonomice na tento sektor, postavený na předchozím scénáři projektu DIGIT-FUR, který se zaměřoval na digitální transformaci do r. 2025. Tato nová prognóza může stimulovat ucelenější přemýšlení o budoucích strategických aktivitách a investicích. Formulace této vize je následující:

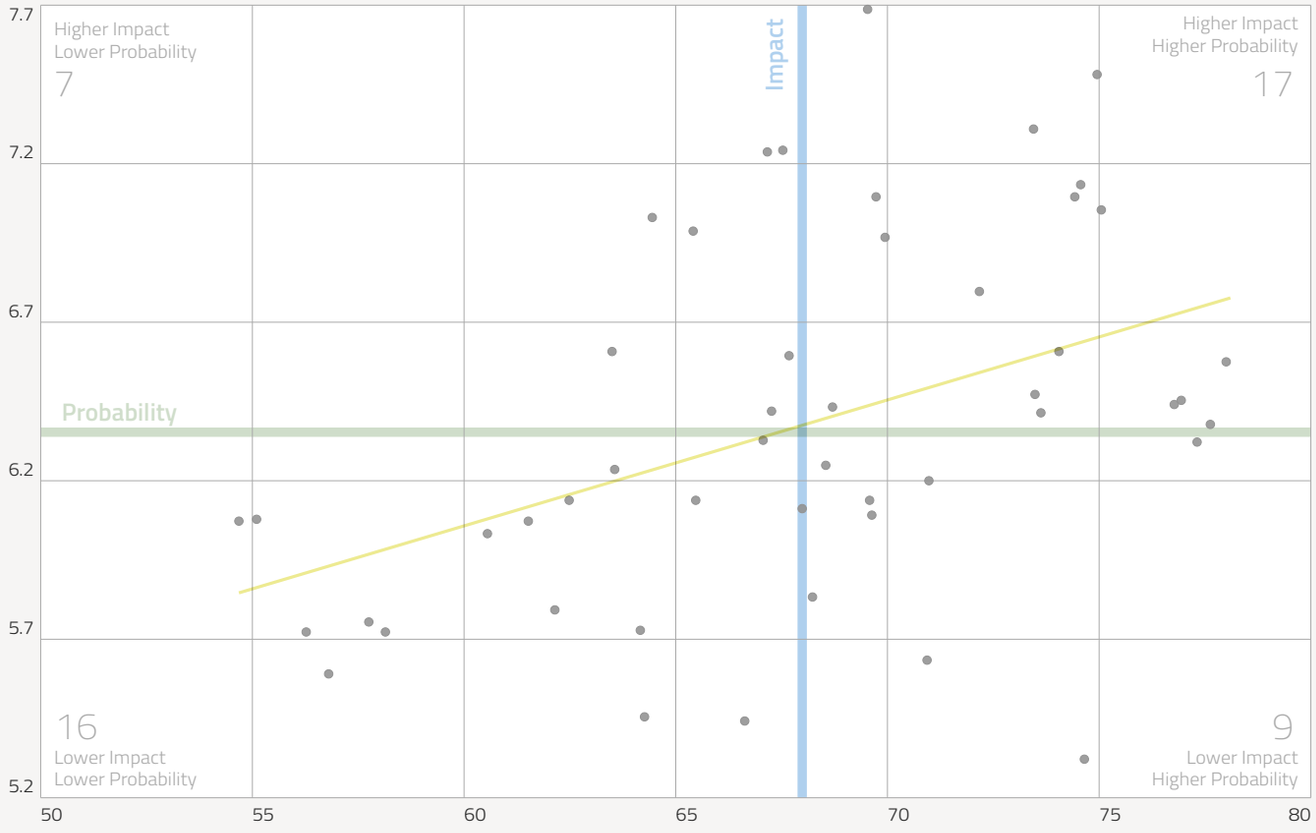
*Do r. 2030, s široce **digitalizovaným nábytkářským průmyslem**, bude výroba dřevěného nábytku nabízet **produkty a služby** s **designem ohleduplným vůči životnímu prostředí** založeným na **nízkém dopadu a vysledovatelných surovinách, udržitelných výrobních postupech**, podpoře **nejlepšího využití a scénářů obnovy** materiálů a vyřazených produktů. Zákazníci (B2B nebo B2C) budou vyžadovat podrobnější informace o produktech a jejich **udržitelných charakteristikách**, včetně ukazatelů životního cyklu. Klíčem k úspěšnému dosahování cílů cirkulární ekonomiky bude posílení postavení spotřebitelů. Úřady (na místní, národní a evropské úrovni) podpoří oběhové hospodářství **udržitelnými scénáři pro konec životnosti** materiálů a dřevěných výrobků rozšiřováním **státních a soukromých programů pro zadávání zelených zakázek** a podporou politik pro vyšší efektivitu materiálů.*

Tato vize jasně ukazuje na **vzájemnou úzkou spojitost mezi přechodem průmyslu na cirkulárnější ekonomiku a jeho digitální transformací**. Při kombinaci těchto dvou vývojových hledisek a silných a dlouhodobých vzájemných vlivů může realistickou a užitečnou předpověď o charakteru nábytkářského průmyslu v několika příštích letech a desetiletích poskytnout jen **společná analýza** jejich dopadu, aby pomohla při **strategickém rozhodování zúčastněných stran v tomto průmyslu**.

Úplné zprávy najdete na: circularfurniture-sawyer.eu/downloads/

Z obrázku vyplývá, že neexistuje jasná korelace mezi dopadem a pravděpodobností a že nemáme k dispozici prognózy vývoje s hodnotami dopadu nižšími než 5 a vyššími než 8 na stupnici od 0 do 10.

Obr. 2. Rozdělení 49 prognóz vývoje podle jejich hodnot pravděpodobnosti a dopadu



In the following table, we present the 49 forecasted evolutions ranked according to their level of importance (impact x probability) as outcome of the survey results.

Table 3 - Classification of forecasted evolutions 2030 - workshop results.

Class	Instrument	**Forecasted Evolution** Importance = Probability x Impact. Probability: scale 1 - 100. Impact: scale 1 - 10	**Importance**	Probability Mean Value	Probability Standard devation	Impact Mean Value	Impact Standard devation
1	ECD	The furniture is designed to reduce the impact of used raw materials (use of recycled materials, reduction of hazardous substances content, use of wood with lower environmental impact, use of proximity wood, etc.), provoking changes in the supply chains of companies and in the managing of old furniture collected when the new one is delivered, generating new business models.	561	75	15	7,48	1,61
2	ECD	Low, medium and high quality furniture is designed to optimize its recovery at the end of its life cycle (to facilitate materials disassembly and separation, modularity for reuse of certain parts, reuse and remanufacturing enhancement, etc.).	537	73	18	7,30	1,61
3	EPR	Some national authorities define an Extended Producer Responsibility scheme or take-back scheme for some furniture products, forcing to define a system for the collection and treatment of these products at the end of their life cycle, being the organisation that put the product on the market the one responsible for covering the associated costs.	534	70	23	7,68	1,79
4	CE	The implementation of the actions proposed in the Circular Economy Package of the EC (COM (2015) 614) will generate changes in the productive models of the furniture sector, developing processes and machinery that are more efficient and generating less waste, based on lean manufacturing principles and new ICT technologies (Industry 4.0).	531	75	16	7,13	1,91
5	CUS	New technologies (e.g. Internet of Things, blockchain, BIM, RFID tags, etc.) are used to improve the traceability of wood products to ensure the chain of custody along the whole value chain and to create Material Passports to facilitate their reusing and recycling.	529	75	14	7,04	1,54
6	GPP	In Europe, it has been achieved the objective that 50% of public procurement tenders for furniture include all environmental criteria of green public procurement set by the European Union or all the ones set by each country. This percentage will be higher than 70%, if we include also those public procurement tenders for furniture that include only some of these environmental criteria.	528	74	17	7,09	1,69
7	CUS	Customers, final customers (B2C) and especially intermediate customers (B2B), demand that the furniture product has a chain of custody certification, according to existing schemes (FSC, PEFC, etc.), which have become a standard.	512	78	16	6,57	1,96
8	FEM	The European Commission decides to regulate the emission of formaldehyde of products at European level, fixing a value lower than category E1 (<0.124 mg/m3) currently fixed in several European countries and in the voluntary agreement of EPF (European Panel Federation) members, bringing harmonization to a fragmented single market.	496	77	17	6,44	1,92
9	ECD	The majority of furniture is designed to extend its life cycle (more resistant materials/joints, facilitate its repair and maintenance, etc.), increasing its quality. The furniture that is not meant to last, will be designed in such a way that is easy to re/upcycle.	494	70	19	7,09	1,84
10	CUS	Customers, final customers (B2C) and especially intermediate customers (B2B), demand that the furniture products use wood from forests with certified management according to certificates such as FSC, PEFC, or others equivalent, which have become a standard.	494	78	16	6,36	1,95
11	REA	The proposal presented within the REACH Regulation framework is approved to restrict the placing on the market or the use of items that emit formaldehyde at concentration levels ≥ to 0.124 mg/m3 (equivalent to category E1), bringing harmonization to a fragmented single market	494	77	17	6,43	2,06
12	GPP	All European countries have developed Green Public Procurement criteria for furniture, either by adopting the EU recommendations or by developing their own. Only some of them will approve a law based on these criteria, the others will just consider them as recommendations. A European directive to implement green public procurement will be adopted and countries will follow it, but some of them probably won't have it fully transposed by 2030.	490	72	18	6,79	1,56
13	GBC	The criteria associated with the use of furniture that uses sustainable materials acquires greater relevance in the systems of Green building certification (e.g. LEED or BREEAM), encouraging their use in those buildings that aim to obtain this type of certification. This will act as a driver that will encourage the use of these more sustainable materials, also for buildings that don't have these certifications.	489	74	17	6,60	1,77
14	ErP	Ecological design requirements are defined for products not-related with energy, such in the case of furniture sector products, under the eco-design (ErP) directive framework (2009/125/EC). These criteria include aspects of materials efficiency such as durability requirements, reparability, spare parts availability, disassembling easiness, use of materials, source of materials (from previous products, raw material, reused materials), etc. Private sector could exploit this to create new services and opportunities.	489	68	24	7,23	1,63

Class	Instrument	**Forecasted Evolution** Importance = Probability x Impact. Probability: scale 1 - 100. Impact: scale 1 - 10	**Importance**	Probability Mean Value	Probability Standard devation	Impact Mean Value	Impact Standard devation
15	CE	The implementation of the actions proposed in the Circular Economy Package of the EC (COM (2015) 614) will produce changes in the customer service models, increasing the information to be provided to customers (for example: content of hazardous substances, product durability, manuals for repair and maintenance, instructions for the end of life management, etc.).	488	77	19	6,31	2,05
16	CUW	The European Commission reinforces its circular economy strategy by promoting the strategy of cascading use in the wood sector, facilitating the recovery of wood in the different stages of the product, optimising its use according to the wood quality (less contaminated, etc.)	487	70	19	6,96	1,71
17	CE	The furniture sector will be an established priority in the Circular Economy Package of the EC (COM (2015) 614)[1], with specific legislation to increase the reuse and recycling of its products, setting specific objectives of recovery similar to existing EPR schemes.	486	67	17	7,23	1,53
18	REA	The REACH Regulation (EC 1907/2006) classifies some of the substances used in the furniture products manufacturing, such as toxic flame retardants, formaldehyde or VOCs, as restricted substances (Annex XVII), in the list of candidates or as extremely worrying substances (substances of very high concern – SVHC-) that require authorization (Annex XIV).	475	74	20	6,47	1,93
19	EWC	There is a growing market and demand for wood waste that will be used as secondary raw materials in different sectors, ensuring their quality and traceability.	472	74	19	6,40	1,83
20	CE	Wood and wood-based derivatives will be considered a priority raw material in future reviews of the Action Plan in Circular Economy of the European Commission (COM (2015) 614), developing specific legislation in this regard to promote how and where wood is grown, how wood is maintained, as well as its efficient use and recovery in wood and wood-based derivatives.	457	65	15	6,98	1,63
21	CE	Business models of the furniture sector based on servitization are common in certain sectors (e.g. office, student rental, co-workers, young professionals, etc.), where the manufacturer owns the product and offers the use of furniture as a service to consumers for a certain fee, which covers its maintenance, replacement, etc.	453	64	24	7,02	2,24
22	EWC	End-of-life waste criteria are defined for wood waste from the industry (Directive 2008/98/EC), which will produce quality standards for secondary raw materials. This scenario is not foreseen for post-consumer wood waste (contamination, quality guarantees, etc.)	446	68	17	6,59	1,98
23	CUS	More than 70% of the furniture sector products will be made out of CoC certified resources. Big and medium companies and companies with high export rates will have this certification as a standard. Small companies will have difficulties to obtain this certification due to high costs of certification and high administrative efforts for developing, documenting and implementing the system.	441	69	18	6,42	1,77
24	FOR	The activities of greenhouse gas emissions compensation generate a reactivation of forest resources and plantations, making necessary their better management, traceability and monitoring, which will also supply the furniture industry.	440	71	18	6,20	2,05
25	BE	Based on the European Bioeconomy strategy, the European Commission will encourage significant synergies with other sectors of primary production that use and produce biological resources arise, optimizing raw materials consumption and minimizing generation of waste.	431	67	16	6,41	1,73
26	FEM	Consumers would not have the sufficient knowledge to appreciate that a particular product does not emit formaldehyde, thus a specific label of "formaldehyde-free" to inform consumers will not be needed/effective.	428	69	23	6,24	2,27
27	WEE	Some specific products that contain electrical and electronic components are affected by the requirements of the WEEE Directive (2012/19/EU), and therefore, at the end of their life cycle, they require a specific disassembly and treatment.	427	70	22	6,13	2,20
28	FLA	The use of the most toxic and dangerous flame retardants in furniture products is forbidden. Compliance with the flammability requirements set by current legislation will be secured by alternatives, such as material combinations that in themselves are fire safe, new materials, product design, including the use of interliners, with lower risk for people and the environment, and in addition smart fire prevention and education for consumers will be encouraged.	424	70	18	6,09	1,67
29	BE	The European Bioeconomy strategy has identified the furniture sector as a relevant sector to achieve its objectives, setting concrete actions that bind sector companies.	424	67	15	6,32	1,63

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Class	Instrument	**Forecasted Evolution** Importance = Probability x Impact. Probability: scale 1 - 100. Impact: scale 1 - 10	**Importance**	Probability Mean Value	Probability Standard devation	Impact Mean Value	Impact Standard devation
30	FBP	The EU furniture sector adopts concrete and binding commitments aligned with the "Forest-based Industries 2050: a vision for sustainable choices in a climate-friendly future" and in particular aligned with the following goals of the vision: i) eradicate waste in circular economy by closing materials loops with a sector target of at least 90% material collection and 70% recycling rate; ii) drive resource-efficiency in the industrial value chain by enhancing productivity in all areas (materials, manufacturing, logistics); iii) meet the increasing demand for raw materials by maximizing new secondary streams and ensuring primary raw materials supply from sustainably managed forests and iv) satisfy the growing demand for climate-friendly products by increasing the use of wood and wood-based products in our daily lives.	419	64	18	6,60	1,40
31	WEE	Some specific furniture sector products that contain electrical and electronic components are affected by the requirements of the WEEE Directive (2012/19 / EU), and guidelines are set for specific disassembly of the electrical and electronic components inside the normal recovery circuit of furniture waste.	415	68	21	6,11	2,05
32	CE	The implementation of the actions proposed in the Circular Economy Package of the EC (COM (2015) 614) will produce changes in the customer service models, increasing the minimum guarantee period and the time of spare parts availability.	401	66	21	6,13	2,07
33	FEM	The European Commission does not propose to reduce the formaldehyde occupational exposure limit below the current value of 0.3 ppm.	399	71	18	5,62	1,73
34	ILL	The type of products covered by the Regulation (EU) No. 995/2010 or EUTR is extended, reducing the number of exclusions and extending the scope to medical furniture and seating furniture (e.g. sofas, chairs, etc.). Market surveillance will be stronger and the traceability of wood from forests to furniture companies will be ensured (through sustainable and traceable chains).	397	68	17	5,82	1,92
35	ROH	Furniture sector products that contain electrical and electronic components are affected by the requirements of the RoHS Directive (EU 2017/2102), and therefore their components cannot contain substances such as brominated flame retardants (PBDE, PBB) or heavy metals such as lead, mercury, cadmium or hexavalent chromium, including components purchased and finished outside the EU.	396	75	20	5,31	2,15
36	FOR	The EU Forest Strategy extends beyond forests and deals with aspects of its value chain, such as how forest resources are used to produce products or services, taking into account regional/local conditions but without specifying requirements that imply compliance.	396	64	21	6,22	1,48
37	ECL	50% of the furniture sector products have at least one type of environmental ecolabel. Ecolabel Type II will be the most common one, but Type I and III will also grow.	383	63	20	6,13	1,55
38	ECL	Customers (final or intermediate customers) will not value ecolabels Type I (according to ISO 14024) in a massive way. Just some of these ecolabels will be widely recognized and clients will consider them important, especially in specific markets and for specific products.	373	62	22	6,07	1,78
39	EMS	Some intermediate customers (B2B), value positively that the furniture products supplier in the sector has a certified environmental management system, either EMAS or ISO-14001, which has become a competitive advantage.	367	64	20	5,72	2,14
40	ECL	Intermediate customers (B2B) positively value that the furniture products have a Type III ecolabel (according to ISO 14025), which has become a competitive advantage. Final customers (B2C) will still have many difficulties to appreciate/understand the value of Type III ecolabel for products.	365	61	21	6,02	2,02
41	FLA	Consumers do not have sufficient knowledge on fire safety to determine whether it would be appreciated that a product does not contain dangerous flame retardants (and a label could have the opposite desired effect, leading the consumer to think that fire safety decreases if no flame retardants are used), thus a specific label of "flame retardant-free" would not be effective/desired.	362	67	23	5,43	2,00
42	EMS	In Europe, 15% of companies of the furniture sector have a certified environmental management system, either EMAS or ISO-14001. The impact on certified companies will be high along the whole value chain.	360	62	24	5,78	2,00
43	ILL	The signature of an agreement, under the umbrella of the FLEGT Regulation (Regulation (EC) No 2173/2005), will be compulsory between countries that want to sell wood / wood products in the EU. A stronger market surveillance will prevent the importation and sale of illegal timber products in the EU.	350	64	18	5,44	1,83
44	ECD	20% of the European furniture sector companies will adopt criteria defined by Ecodesign ISO-14006 management system, but only 5% will reach the certification.	334	55	23	6,07	1,90
45	ECD	Few final customers (B2C) and some intermediate customers (B2B), positively value that the furniture products supplier in the sector has an Eco-design ISO-14006 management system, which has become a competitive advantage in niche markets and public procurement.	333	58	24	5,72	1,82

Class	Instrument	**Forecasted Evolution** Importance = Probability x Impact. Probability: scale 1 - 100. Impact: scale 1 - 10	**Importance**	Probability Mean Value	Probability Standard devation	Impact Mean Value	Impact Standard devation
46	END	In some pilot cases and specific regions, wood furniture and panels waste are used to produce second generation biofuels, which meet the sustainability requirements set out in Directive 2018/2001/EU.	332	58	22	5,74	1,98
47	EPR	Some major manufacturers and distributors of the furniture sector and some municipalities at local level agree to define an Extended Producer Responsibility scheme or take-back scheme, which allows the products collection, return and treatment at the end of their life cycle.	332	55	26	6,06	2,39
48	ECL	The different Type I ecolabels criteria that affect the furniture sector are not unified yet, this is hindering their understanding by customers (for example European label, Blue Angel, Nordic Swan, etc.).	322	56	25	5,71	2,18
49	ECL	The amount of companies with a Type II ecolabel (according to ISO 14021) will increase a lot until 2030. This is a positive first step for this trend, but educated consumers will not give much value to self-declarations.	317	57	21	5,58	1,93

Topics Acronyms Code/ Instrument

CUW	*Cascading use of wood*
CUS	*Chain of Custody FSC/PEFC*
CE	*Circular Economy Package of the EC*
ECD	*Ecodesign ISO14006*
ECL	*Ecolabels (Type I, II, III)*
EWC	*End-of-waste criteria*
END	*Energy Directive*
EMS	*Environmental Management Systems ISO14001/EMAS*
EPR	*EPR schemes*
ErP	*ErP Directive*
FOR	*EU industry policy for Forestry*
FLA	*Flame retardants*
FBP	*Forest Based Industries Blueprint*
FEM	*Formaldehyde emissions*
GBC	*Green building certification BREEAM/LEED*
GPP	*Green Public Procurement*
ILL	*Illegal logging and illegal timber trade*
REA	*REACH Regulation*
ROH	*RoHS Directive*
WEE	*WEEE Directive*

We can see the following ones in the graphic first quadrant with higher probability and higher impact (probability > 68; impact > 6,35):

- Chain of custody
- Green Public Procurement
- REACH Regulation
- Cascading use of wood
- Green building certification BREEAM/LEED
- Ecodesign
- End-of-waste criteria
- EPR – Extended Producer Responsibility schemes

We can see the following ones in the graphic second quadrant with lower probability and higher impact (probability < 68; impact > 6,35)

- ErP Directive
- Forest Based Industries Blueprint
- Bioeconomy
- Circular Economy Package of the EC

Koncepce a rámec pro analýzu změn profesních profilů

V této sekci předkládáme rámec a koncepci, které jsme použili pro analýzu dopadu cirkulární ekonomiky na nábytkářský průmysl EU z pohledu dvojí transformace. Za základ pro analýzu jsme vzali rámec zásad ReSOLVE vytvořených střediskem McKinsey Center a nadací Ellen MacArthur Foundation (Growth Within: A Circular Economy Vision for a Competitive Europe, 2015 bit.ly/2MreFWM). Zanalyzovali jsme, jak různé zásady ovlivnily stávající úkoly profilů povolání a eventuálně vytvořily úkoly nové.

Na základě změn v úkolech profesních profilů jsme identifikovali vývoj rizik BOZP a dovedností potřebných následkem přechodu nábytkářského průmysl k cirkulárnější ekonomice. V následujícím oddíle představujeme tyto změny pro každý z jedenácti profilů pomocí dále uvedených tabulek.

Úplné zprávy najdete na: circularfurniture-sawyer.eu/downloads/

Vysvětlení zásad ReSOLVE

V této první tabulce jsou stručně vysvětleny zásady identifikované střediskem McKinsey Center a nadací Ellen MacArthur Foundation jako zásadní akcelerátory přechodu na cirkulárnější ekonomiku. Mírně jsme je adaptovali na nábytkářský průmysl.

Tabulka 4. Vysvětlení zásad ReSOLVE u nábytkářského průmyslu

	Zásady	Stručný popis
Obnovit	Přesunout se k obnovitelným energiím	Použití obnovitelných energií, například solární, větrné, včetně biomasy (např. možné využití dřevěného odpadu jako zdroje energie)
	Přesunout se k obnovitelným materiálům	Použití dřevěných materiálů z udržitelnějších zdrojů nebo náhrada jiných materiálů (např. dílů z plastů, kovů nebo textilií) za alternativy z obnovitelných zdrojů
	Znovu obnovit, udržet a regenerovat zdraví ekosystémů	Pomoc při regeneraci ekosystémů poškozených aktivitami tohoto průmyslu, např. podpora udržitelné správy lesů a plantáží, regenerace půdy, zachování biodiverzity atd.
	Vracet znovuzískané biologické zdroje do biosféry	Usnadnit vracení dřevěného odpadu do biosféry (např. vracení popela ze spáleného dřeva zpět do lesa jako živiny apod.).
Sdílet	Snižovat rychlost nahrazování produktů za nové a více používat výrobky sdílené různými uživateli	Podpora sdílení produktů, například sdílením soukromých produktů nebo veřejným sdílením skupiny produktů.
	Opětovně využívat výrobky během jejich technického životního cyklu	Podpora opětovného používání výrobků, například usnadněním procesů repasování a přepracování (např. čištění, demontáž apod.) a poskytování informací o vlastnostech výrobků (např. postup při demontáži, použité materiály a součásti atd.).
	Prodlužovat životní cyklus výrobků údržbou	Usnadnění údržby výrobků uživatelům pomocí pokynů k údržbě nebo poskytováním specializovaného servisu (např. požadavky na údržbu povrchů, doporučené přípravky k údržbě atd.).
	Prodlužovat životní cyklus výrobků opravami	Usnadnění oprav výrobků (uživatelem nebo specializovaným servisem), například dostupností informací o opravě, náhradních dílů a jejich rychlým dodáním za rozumnou cenu; usnadněním demontáže/montáže produktů, prodloužením záruční lhůty nebo poskytováním informací o vlastnostech produktu (např. postup při demontáži, použité materiály a součástky atd.).
	Prodlužovat životnost výrobků pomocí designu pro odolnost	Prodloužení trvanlivosti výrobků prostřednictvím návrhu, například použitím materiálů a armatur, které dlouho vydrží, předcházením zastarávání z estetického hlediska, použitím modulárního/přizpůsobitelného designu atd.

	Zásady	Stručný popis
Optimalizovat	Zvyšovat výkon/účinnost produktů	Zvyšování výkonnosti výrobků, například modulárním designem, použitím menšího množství dílů a materiálů, nabídkou více funkcí atd.
	Upravovat výrobky na míru / vyrábět na zakázku	Úprava produktů podle potřeb a požadavků zákazníka a výroba podle poptávky (např. velikost dávky 1, hromadné zákaznické úpravy).
	Věnovat se reprodukovatelné a přizpůsobitelné výrobě	Modernizace výrobních procesů, aby bylo možné je více reprodukovat, přizpůsobovat, aby byly flexibilní a samostatné vzhledem ke změnám v poptávce a potřebám výroby (Průmysl 4.0).
	Minimalizovat odpad z výroby a dodavatelského řetězce	Snižovat tvorbu odpadu po celou dobu životnosti výrobku, například obalů (od dodavatelů a distribuce produktů), šrotu z výroby atd.
	Zvyšovat efektivitu výrobních procesů	Zvyšování efektivity výrobních procesů, například používáním nových technologií 4.0 (např. robotů, velkých dat atd.), účinnějších zařízení nebo nových metod (např. štíhlou výrobou).
Vytvářet kruh	Repasovat výrobky a/nebo díly	Repasování výrobků nebo dílů přímo, například stanovením systémů sběru, implementací postupů k repasování (tj. třídění a čištění, výměna dílů/materiálů, atd.) a určením mechanismů pro testování a kontrolu kvality.
	Zavádět programy zpětného odběru výrobků	Zahájení programů zpětného odběru výrobků ve firmě (tj. sběrná místa, reverzní logistika, procesy zpracování, scénář pro konec životnosti u znovuzískaných materiálů atd.).
	Recyklovat materiály	Větší používání recyklovaných materiálů (např. na bázi dřeva), stanovení požadavků na kvalitu a dodávky recyklovaných materiálů, testovací postupy, mechanismy ke kontrole kvality atd.
	Podporovat kaskádové využívání dřeva	Podpora kaskádového využívání dřeva, například usnadněním recyklace (materiálová kompatibilita atd.), zabránění používání nebezpečných látek, poskytování informací o použitých materiálech a látkách apod.
	Podporovat extrakci biochemických látek z organických odpadů	Podpora anaerobní digesce (vyhnívání) nebo extrakce biochemických látek z dřevěného odpadu, například zabránění používání možných kontaminantů k usnadnění procesu obnovy.
Virtualizovat	Virtualizovat přímé aspekty výrobku	Dematerializovat (virtualizovat) samotný výrobek, například prostřednictvím virtuálního designu pro zákazníka, simulací výkonu produktu atd.
	Virtualizovat nepřímé aspekty výrobku	Dematerializovat (virtualizovat) nepřímé aspekty výrobku, například online nákup, virtuální asistenční služby, digitální informace o výrobku pro zákazníky apod.
Nahradit	Nahrazovat staré materiály za technicky vyspělé, obnovitelné	Náhrada starých materiálů za jiné, moderní, obnovitelné materiály, např. nové typy laminátů, nové nátěry, nové přísady apod.
	Používat nové technologie	Implementace a přijetí nových technologií 4.0 v produktových a výrobních procesech (např. aditivní výroba, internet věcí, rozšířená realita atd.)
	Vybírat nové výrobky a služby	Vyvíjení nových produktů, služeb a obchodních modelů, například tzv. servitizace (produkt jako služba), multifunkční produkt atd.

Úroveň vlivu legislativy, dobrovolných nástrojů a nástrojů politik na zásady ReSOLVE

Následující tabulka znázorňuje předpokládanou úroveň dopadu legislativy, dobrovolných nástrojů a nástrojů politik na navržené zásady rámce ReSOLVE pro cirkulární ekonomiku v r. 2030.

0. Prognóza žádného vlivu na výrobce nábytku na bázi dřeva na r. 2030
1. Prognóza malého vlivu na výrobce nábytku na bázi dřeva na r. 2030
3. Prognóza středně velkého vlivu na výrobce nábytku na bázi dřeva na r. 2030
5. Prognóza velkého vlivu na výrobce nábytku na bázi dřeva na r. 2030

Vyšší hodnoty zvýrazňují ty nástroje, jež by mohly mít větší dopad na zásady, a zásady, které by tyto nástroje mohly více ovlivnit. Tyto údaje mohou společnosti použít k řádnému vypracování vlastní strategie pro cirkulární ekonomiku a jejímu sladění s těmito nástroji.

Tabulka 5. Úroveň vlivu legislativy, dobrovolných nástrojů a nástrojů politik na zásady ReSOLVE

		Obnovit			
		Přesunout se k obnovitelným energiím	Přesunout se k obnovitelným materiálům	Znovu obnovit, udržet a regenerovat zdraví ekosystémů	Vracet znovuzískané biologické zdroje do biosféry
Legislativní nástroje	Balík opatření EK pro cirkulární ekonomiku	3	5	3	3
	Směrnice o odpadních elektrických a elektronických zařízeních (OEEZ)	0	0	0	0
	Omezení nebezpečných látek v elektrických a elektronických zařízeních (ROHS)	0	0	0	0
	Směrnice o energetických spotřebičích (směrnice o ekodesignu)	0	3	1	0
	Rozšířená odpovědnost výrobce (programy EPR)	3	3	1	3
	Nebezpečné látky / nařízení REACH	0	3	1	1
	Formaldehydové emise / těkavé organické látky	0	1	0	0
	Pravidla EU ohledně kritérií pro konec životního cyklu odpadů	3	3	1	3
	Látky zpomalující hoření	1	1	0	0
	Směrnice o obnovitelné energii (RED II)	5	0	0	3
	Nelegální těžba dřeva a nelegální obchod se dřevem	0	3	3	0
Dobrovolné nástroje	Zadávání zelených veřejných zakázek	1	5	1	0
	Environmentální management ve společnostech	3	1	3	3
	Metodika ekodesignu	3	5	0	1
	Ekoznačky (typ I, II a III)	1	3	1	0
	Certifikace zpracovatelského řetězce	0	5	5	1
	Certifikace zelených budov	1	3	1	0
Zásady	Kaskádové využívání dřeva	3	5	1	3
	Průmyslová politika EU pro lesnictví	1	3	3	1
	Návrh pro průmyslová odvětví založená na lesnictví	1	3	1	1
	Bioekonomika	1	3	3	1
	Celkem:	30	58	29	24

	Sdílet					Optimalizovat					Vytvářet kruh					Virtualizovat		Nahradit			
	Snižovat rychlost nahrazování produktů za nové a více používat výrobky sdílené různými uživateli	Opětovně využívat výrobky během jejich technického životního cyklu	Prodlužovat životní cyklus výrobků údržbou	Prodlužovat životní cyklus výrobků opravami	Prodlužovat životnost výrobků pomocí designu pro odolnost	Zvyšovat výkon/účinnost produktů	Upravovat výrobky na míru / vyrábět na zakázku	Věnovat se reprodukovatelně a přizpůsobitelně výrobě	Minimalizovat odpad z výroby a dodavatelského řetězce	Zvyšovat efektivitu výrobních procesů	Repasovat výrobky a/nebo díly	Zavádět programy zpětného odběru výrobků	Recyklovat materiály	Podporovat kaskádové využívání dřeva	Podporovat extrakci biochemických látek z organických odpadů	Virtualizovat přímé aspekty výrobku	Virtualizovat nepřímé aspekty výrobku	Nahrazovat staré materiály za technicky vyspělé, obnovitelné	Používat nové technologie	Vybírat nové výrobky a služby	Celkem:
	3	5	3	3	5	3	3	3	5	3	3	5	5	3	1	3	3	3	3	5	84
	0	1	0	1	1	1	1	1	3	1	1	3	3	1	0	0	1	1	3	1	24
	0	0	0	0	0	0	1	1	0	0	0	0	3	3	1	0	1	1	1	0	12
	1	3	1	1	3	3	1	1	1	1	3	1	3	3	0	1	3	1	1	1	37
	3	5	3	5	5	3	1	3	5	3	5	5	3	3	1	1	3	3	3	5	78
	0	3	1	1	1	1	3	3	1	3	1	1	3	5	1	1	1	3	3	1	42
	0	1	1	1	1	1	3	3	0	1	0	0	1	3	0	0	1	5	3	0	26
	0	0	0	0	0	1	0	0	5	3	1	1	5	3	3	0	0	1	0	1	34
	1	3	0	1	3	1	3	3	0	1	1	1	3	3	1	1	1	3	3	0	35
	0	0	0	0	0	0	0	0	3	3	0	1	0	1	3	0	0	0	1	1	21
	0	0	0	0	0	0	1	3	1	1	1	1	3	1	0	0	1	1	3	3	26
	3	3	5	5	5	5	3	3	1	3	3	3	5	3	0	3	3	3	3	5	74
	0	0	0	0	1	0	1	3	3	5	1	3	3	1	0	0	3	1	1	1	37
	3	5	3	5	5	3	1	0	1	1	3	1	5	3	1	3	1	3	3	5	64
	1	3	1	3	3	3	3	1	1	3	3	1	5	3	0	1	5	3	3	3	54
	0	0	0	1	0	1	1	3	1	3	1	1	3	3	1	1	3	3	3	3	43
	1	1	1	1	3	3	3	1	1	1	1	1	3	1	0	1	1	1	1	3	34
	3	3	1	1	3	1	1	1	3	3	3	3	5	5	3	1	1	1	3	3	60
	0	0	0	0	0	0	0	1	1	3	1	1	1	1	1	0	0	0	1	1	20
	1	3	1	3	3	1	3	5	1	5	3	1	3	3	0	3	3	3	3	5	59
	1	1	0	0	1	0	0	1	1	1	1	3	3	3	1	0	1	3	3	3	35
	21	40	21	32	43	31	33	40	38	48	36	37	68	55	18	20	36	43	48	50	

Žebříček vlivu legislativy, dobrovolných nástrojů a nástrojů politik na zásady ReSOLVE

Následující dvě tabulky jsou sestaveny na základě výsledků předchozí analýzy.

V první tabulce je znázorněn žebříček zásad ReSOLVE, které jsou nejvíce ovlivněny výše uvedenou legislativou a dobrovolnými nástroji a nástroji politik, přičemž hrají klíčovou roli v urychlování přechodu nábytkářského průmyslu směrem k cirkulární ekonomice.

Druhá tabulka znázorňuje žebříček nástrojů a politik s největším dopadem na zásady ReSOLVE.

Tabulka 6. Žebříček vlivu zásad ReSOLVE

Zásady ReSOLVE	Skóre
Recyklovat materiály	68
Přesunout se k obnovitelným materiálům	58
Podporovat kaskádové využívání dřeva	55
Vybírat nové výrobky a služby	50
Používat nové technologie	48
Zvyšovat efektivitu výrobních procesů	48
Prodlužovat životnost výrobků pomocí designu pro odolnost	43
Nahrazovat staré materiály za technicky vyspělé, obnovitelné	43
Opětovně využívat výrobky během jejich technického životního cyklu	40
Věnovat se reprodukovatelné a přizpůsobitelné výrobě	40
Minimalizovat odpad z výroby a dodavatelského řetězce	38
Zavádět programy zpětného odběru výrobků	37
Repasovat výrobky a/nebo díly	36
Virtualizovat nepřímé aspekty výrobku	36
Upravovat výrobky na míru / vyrábět na zakázku	33
Prodlužovat životní cyklus výrobků opravami	32
Zvyšovat výkon/účinnost produktů	31
Přesunout se k obnovitelným energiím	30
Znovu obnovit, udržet a regenerovat zdraví ekosystémů	29
Vracet znovuzískané biologické zdroje do biosféry	24
Snižovat rychlost nahrazování produktů za nové a více používat výrobky sdílené různými uživateli	21
Prodlužovat životní cyklus výrobků údržbou	21
Virtualizovat přímé aspekty výrobku	20
Podporovat extrakci biochemických látek z organických odpadů	18

Tabulka 7. Žebříček vlivu nástrojů a politik cirkulární ekonomiky

Nástroje	Skóre
Balík opatření EK pro cirkulární ekonomiku	84
Rozšířená odpovědnost výrobce (programy EPR)	78
Zadávání zelených veřejných zakázek	74
Metodika ekodesignu	64
Kaskádové využívání dřeva	60
Návrh pro průmyslová odvětví založená na lesnictví	59
Ekoznačky (typ I, II a III)	54
Certifikace zpracovatelského řetězce	43
Nebezpečné látky / nařízení REACH	42
Environmentální management ve společnostech	37
Směrnice o energetických spotřebičích (směrnice o ekodesignu)	37
Látky zpomalující hoření	35
Bioekonomika	35
Certifikace zelených budov	34
Pravidla EU ohledně kritérií pro konec životního cyklu odpadů	34
Nelegální těžba dřeva a nelegální obchod se dřevem	26
Formaldehydové emise / těkavé organické látky	26
Směrnice o odpadních elektrických a elektronických zařízeních (OEEZ)	24
Směrnice o obnovitelné energii (RED II)	21
Průmyslová politika EU pro lesnictví	20
Omezení nebezpečných látek v elektrických a elektronických zařízeních (ROHS)	12

Rizika a nebezpečí v nábytkářském dřevozpracujícím průmyslu

Zpracovávání dřeva v nábytkářském průmyslu může být pro pracovníky nebezpečné. Od používání strojů a nástrojů, přes manipulaci těžkých materiálů až po expozici prachu, hluku a chemickým látkám – k potenciálně škodlivému dopadu může docházet kdykoli. Tyto události mohou negativně ovlivňovat zdraví pracovníků a způsobovat například kožní a dýchací onemocnění. Mohou vést také k úrazům, jako je ztráta prstů, nebo dokonce k usmrcení.

Tabulka 8 souhrnně popisuje jednotlivé druhy nebezpečí, jimž mohou být pracovníci v závodech na výrobu dřevěného nábytku vystaveni. Je výsledkem práce našeho externího odborníka na BOZP založené na různých zdrojích informací. MODŘE jsou znázorněna nebezpečí vznikající v důsledku digitalizace v r. 2025. Nová rizika vznikající v důsledku přechodu na cirkulární ekonomiku v r. 2030 jsme označili ZELENĚ.

Nebezpečí uvedená v tabulce se vztahují na nábytkářský průmysl – výrobní závody nábytku – a na potenciálně nové činnosti, které se v těchto závodech mohou vykonávat, následkem nových výrobních procesů a obchodních modelů vznikajícím díky cirkulárnější ekonomice (např. repasování, opravy atd.).

Za předpokladu, že BOZP bude součástí podnikového řízení a bude zahrnuto do navrhování výrobků ohleduplných k životnímu prostředí (např. snadnější demontáž, menší obsah nebezpečných látek atd.), budou mít pracovníci v dřevozpracujícím sektoru ze strategií oběhového hospodářství ohledně zdraví a bezpečnosti práce užitek.

Změny a nebezpečí plynoucí z činností a úkolů recyklačního průmyslu nebo související s novými zdroji energie tato analýza nepokrývá a nebyly do ní zahrnuty. Tato zpráva se rovněž nevěnuje servisu v terénu, jako je údržba a opravy v provozu zákazníka.

Tabulka 8. Běžná a nová rizika a nebezpečí v nábytkářském průmyslu

Jednotlivé kategorie rizik	Podrobnosti rizik v jednotlivých kategoriích a jejich stručný popis
Mechanická rizika	
• Nechráněné pohyblivé díly (kolaborativní robotika), (stlačení, nárazy, rozdrcení, říznutí, amputace, zatažení/zachycení). • Díly nebezpečných tvarů (ostré, špičaté, hrubé). • Pohybující se dopravní prostředky a nástroje (přejetí, převálcování, pády z výšky). • Nekontrolované pohyblivé části (odletující předměty, dřevěné třísky).	Ruční a elektrické nástroje: Riziko píchnutí, pořezání, amputace prstů při použití ručních nebo elektrických nástrojů. K repasování a selektivní demontáži mohou být potřeba nové typy nástrojů. Nechráněné pohyblivé díly: Riziko zachycení částí těla do otáčejících se částí stroje. Díly nebezpečných tvarů (ostré, špičaté, hrubé).
• Uklouznutí a zakopnutí	Uklouznutí, zakopnutí a pády z výšky.
• Pády z výšky	Riziko uklouznutí, zakopnutí a pádů následkem kluzkých povrchů, schodů, překážek na cestách, nevhodné obuvi a používání žebříků způsobem, který není bezpečný.
• Ergonomická rizika	Ergonomická rizika se mohou snížit v závislosti na přebírání specifických úkolů kolaborativními roboty/roboty. Na druhou stranu jsou pracovníci čím dál tím častěji vystavováni ergonomickým rizikům, jako je nedostatek pohybu/nečinnost, protože samostatně pracující stroje a kolaborativní roboty ovládají počítačem od svého pracovního stolu. Riziko pro pracovníky se může snížit díky lepšímu designu výrobků (ekodesignu), pokud je dbáno na takové aspekty jako snazší montáž a demontáž, lepší výběr spojovacích systémů atd. a bezpečnější údržba již od samého začátku.
• Těžká břemena / těžká práce v pohybu	Riziko vzniku bolesti z manipulace těžkých břemen a těžké práce v pohybu. Riziko pro pracovníky se může snížit díky používání robotů / kolaborativních robotů a digitálních strojních zařízení. Demontáž vyráběného zboží může způsobit muskuloskeletální poruchy (např. nepřirozené polohy, zdvihání a přenášení těžkých břemen).
• Nestandardní polohy těla / nevyrovnaná námaha	Riziko vzniku bolesti nebo úrazu z práce v nestandardních polohách těla. Riziko pro pracovníky se může snížit díky používání robotů / kolaborativních robotů a digitálních strojních zařízení. Úkony při demontáži k získání materiálů (destruktivní metody) mohou způsobovat další muskuloskeletální poruchy.
• Opakované pohyby	Riziko vzniku bolesti nebo úrazu z vykonávání opakovaných úkonů.
• Nedostatek pohybu, nečinnost	Riziko vzniku chronické bolesti krku a zad, obezity a kardiovaskulárních onemocnění následkem nečinnosti, dlouhého sezení a nesprávných ergonomických návyků při používání mobilních přístrojů.
Riziko úrazu elektrickým proudem	
• Úraz elektrickým proudem	Riziko zasažení elektrickým proudem u nesprávně udržovaných nebo rozbitých strojů a elektrických kabelů.
• Rizika vyplývající z fyzického působení/faktorů	

Jednotlivé kategorie rizik	Podrobnosti rizik v jednotlivých kategoriích a jejich stručný popis
Rizika vyplývající z fyzického působení/faktorů	
• Hluk	Expozice vysokému hluku ze strojů a nástrojů. Možné používání hlučných strojů při demontáži a opravách. Hluk však může být snížen díky ekodesignu strojních zařízení pracujících tišeji a efektivněji.
• Vibrace	Riziko vibrace rukou a paží z vibrujících nástrojů nebo obrobků. Další možné používání vibrujících nástrojů během repasování výrobků nebo oprav (natěrač atd.). Vibrace však mohou být sníženy díky ekodesignu strojních zařízení pracujících s menšími vibracemi a efektivněji.
• Laserové světlo	Expozice laserovému světlu ze strojů řezajících laserem.
Nebezpečí požáru a výbuchu	
• Hořlavé látky	Výbuch: Nebezpečí výbuchu způsobeného materiály včetně dřevěného prachu a chemických látek. Recyklace dřevěných produktů vede k velkému množství dřevěného prachu a jemných částic při drcení. Bez účinného odsávání prachu se může zvýšit riziko výbuchu. Rozpouštědla, čisticí prostředky a maziva používaná v dřevozpracujícím odvětví mohou být na bázi méně nebezpečných látek (např. rozpouštědel) a zabránit tak nebezpečí požáru.
	Požár: Nebezpečí vzniku požáru způsobeného chemickými látkami a dřevěným prachem. Recyklace dřevěných produktů vede k velkému množství dřevěného prachu a jemných částic při drcení. Bez účinného odsávání prachu se může zvýšit riziko požáru. Rozpouštědla, čisticí prostředky a maziva používaná v dřevozpracujícím odvětví mohou být na bázi méně nebezpečných látek (např. rozpouštědel) a zabránit tak nebezpečí požáru.
Rizika pracovního prostředí	
Slabé osvětlení	Riziko oslnění nebo nedostatečného či blikajícího světla.
Klimatologické podmínky	Riziko expozice příliš velkému chladu nebo horku v pracovním prostředí v kombinaci s vlhkostí nebo průvanem.
Špatné větrání	Riziko expozice nedostatečnému větrání nebo chladnému vzduchu v pracovním prostředí.
Rizika způsobená nebezpečnými látkami	Při zacházení s nebezpečnými látkami lze snížit riziko pro pracovníky používáním robotů / kolaborativních robotů a digitálních strojních zařízení. Výroba: Nebezpečí lze snížit, pokud bude BOZP zahrnuto do návrhu výrobků/materiálů. Je možné snížit potřebu rozpouštědel, lze používat méně nebezpečných rozpouštědel a látek zpomalujících hoření, pokud bude schválena nová související legislativa nebo zavedeny osvědčené postupy. Recyklace/používání recyklovaných materiálů: Nebezpečí může narůst kvůli nedostatku informací o chemických látkách obsažených v recyklovaných produktech a o způsobech, jak s nimi řádně nakládat.
• Prach	Nebezpečí vzniku rakoviny z dřevěného prachu. Nebezpečí vzniku alergických projevů dýchacích cest z dřevěného prachu. Recyklace – vyšší expozice prachu: vystavení vláknům nebo prachu vznikajícímu při demontáži, repasování a opravách nábytku; prach z recyklovaného materiálu neznámého původu může vést k astmatu z povolání (případy astmatu z povolání byly hlášeny v souvislosti s recyklací dřeva a papíru).
• Rozpouštědla (neurotoxická, alergeny)	Rizika z používání nebezpečných chemických látek, rozpouštědel a dalších materiálů – dermatitida, alergické reakce nebo dýchací obtíže, poškození orgánů. Výroba: potřeba rozpouštědel může klesnout, nebezpečná rozpouštědla mohou být používána méně. Opravy a repasování: zde může spotřeba rozpouštědel narůst (odstraňování laků, čištění použitých částí).
• Karcinogenní látky	Nebezpečí vzniku rakoviny z chemických látek (u produktů k čalounění jsou to nebezpečné látky zpomalující hoření; k úpravě dřevěných výrobků se používají lepidla a potahová činidla jako rozpouštědla barev, lepidla, laky, nátěry a chemické látky k odstraňování barev). Výroba: potřeba rozpouštědel může klesnout, nebezpečná rozpouštědla mohou být používána méně. Recyklace/používání recyklovaných materiálů: Recyklovaný materiál může obsahovat nebezpečné látky – podle nejnovějších výzkumů karcinogenů nebo látek ohrožující rozmnožování (v současnosti omezeny zákonem (REACH)).
• Nové materiály (např. nanomateriály)	Riziko expozice nanomateriálům: znalost zdravotních rizik souvisejících s nanomateriály jsou velmi nedostatečné. Na druhé stranu mohou být nové materiály bezpečnějšími náhražkami za nebezpečné materiály.
• Recyklované materiály	Recyklované materiály v sobě mohou koncentrovat nebezpečné látky (nečistoty a nebezpečné látky zpomalující hoření u výrobků k čalounění) vzhledem k po sobě jdoucím recyklacím. Mohou také změnit složení následkem různých faktorů, jako je světlo, teplo a stárnutí materiálu → neznámý obsah a druh nebezpečných látek.

Jednotlivé kategorie rizik	Podrobnosti rizik v jednotlivých kategoriích a jejich stručný popis
Biologická nebezpečí	
• Manipulace s mikroorganismy: Rizika z necílených aktivit s mikroorganismy.	Nové společnosti používají svůj vlastní odpad jako zdroj energie. Repasování a systémy zpětného odběru starého nábytku mohou pracovníky vystavit nebezpečí expozice mikroorganismům jako plísni.
Psychosociální rizika	Pracovní prostředí a povaha práce jsou samy o sobě důležitými faktory ovlivňujícími zdraví a duševní pohodu pracujících.
• Přílišná pracovní zátěž	Příliš mnoho práce vede u pracovníků k velké časové tísni a práci na pokraji možností.
• Nízká spokojenost s prací	Nízká spokojenost s prací vede u pracovníků k psychologickým potížím a může způsobovat poruchy spánku, bolesti hlavy a gastrointestinální problémy.
• Nejasně definované pracovní úkoly	Špatná organizace práce a nejasně definované úkoly mohou u pracovníků vést k riziku přetížení, nebo naopak nedostatečného zatížení a vyústit v nespokojenost a stres.
• Špatná organizace práce	Špatná organizace práce může u pracovníků vést k riziku přetížení nebo nedostatečnému zatížení, strojovému rytmu a velkému časovému tlaku.
• Nesprávně uspořádané pracovní prostředí (včetně softwaru)	Nedostatečné, nevhodné nebo neudržované vybavení a špatné podmínky prostředí jako nedostatek prostoru, chabé osvětlení nebo příliš velký hluk způsobují u pracovníků stres.
• Opakující se, monotónní práce	
• Kognitivní námaha	Kognitivní interakce se samostatnými zařízením a virtuální realitou způsobuje u pracovníků stres. Vyšší požadavky na kompetence a aktualizované znalosti vývoje cirkulární ekonomiky a recyklačního průmyslu.
• Stres v důsledku dlouhého soustředění a ostražitosti	Dlouhá období soustředění při práci s počítačem a novým softwarem a vykonávání několika úkolů najednou.
• Zvýšené požadavky na flexibilitu	Zvýšené požadavky na flexibilitu: pomocí mobilních přístrojů mohou pracovníci provádět některé úkoly odkudkoli. Pracovníci čelí riziku, že jsou i mimo pracovní dobu permanentně k zastižení. Repasování a opravy, práce s recyklovaným materiálem, rozhodování o udržitelně orientovaných strategiích/produktech/marketingových projektech a cirkulární ekonomice a používání obnovitelných zdrojů energie vyžaduje větší flexibilitu.
• Nedostatečné pracovní zkušenosti	U nového softwaru a digitálních zařízení je potřeba školení; někteří pracovníci nemusí mít dostatečné kompetence a mohou se cítit přetížení, s nedostatečnými znalostmi. Práce s předem zpracovanými materiály: je třeba získat nové dovednosti v celém výrobním cyklu a dodavatelském řetězci. Opravy, repasování a selektivní demontáž vyžadují nové metody a postupy. Rozhodování o cirkulární ekonomice a udržitelné orientovaných strategiích/produktech/marketingových projektech.
• Nedostatečné zapojení do rozhodnutí ovlivňujících pracovníka	Pracovníci, kteří nevidí respekt a docenění, se cítí zranitelní a bezmocní.
• Neefektivní komunikace, nedostatečná podpora managementu nebo kolegů	Neefektivní komunikace kvůli špatné pracovní atmosféře nebo nedostatek kolegů pracovníky stresuje.
• Práce o samotě/v izolaci	Práce o samotě bez kolegů nebo pouze s roboty pracovníky stresuje a izoluje.
• Nevyrovnaná pracovní zátěž: přetížení / nedostatečné zatížení	Nevyrovnaná pracovní zátěž pracovníky stresuje.

Poole C.J.M., Basu S., „Systematic Review: Occupational illness in the waste and recycling sector", Occup Med (Lond), 67(8), str. 626–636, 2017.

Stručný popis dovedností, znalostí a kompetencí a obecné zelené kompetence

Definice následujících pojmů jsou shodné v klasifikaci ESCO (Evropská klasifikace dovedností/kompetencí, kvalifikací a povolání) a v Evropském rámci kvalifikací.

Znalosti

„Znalosti jsou výsledkem asimilace informací prostřednictvím učení. Znalosti jsou souhrnem faktů, principů, teorie a praxe vztahujících se k určité pracovní nebo studijní oblasti."

Na konkrétních a teoretických znalostech stojí jak dovednosti, tak kompetence, rozdíl spočívá ve způsobu, jakým se tyto znalosti aplikují a uvádějí do praxe.

Dovednosti

„Dovednost je schopnost aplikovat znalosti a použít know-how ke splnění úkolů a vyřešení problémů." Dovednosti mohou být kognitivní (zahrnující logické, intuitivní a tvořivé myšlení), nebo praktické (zahrnující manuální zručnost a používání metod, materiálů, nástrojů a přístrojů).

Kompetence

„Kompetence je prokázaná schopnost jednotlivce použít znalosti (teoretické a praktické), dovednosti a osobní, sociální a/nebo metodické schopnosti v reálných situacích v práci a při studiu a v profesním a osobním rozvoji." Jsou popisovány jako odpovědnost a samostatnost. Kompetence jsou tedy již z definice individuální, orientované na proces (s orientací na úkon a rozvoj) a kontextuální.

Termíny dovednost a kompetence se někdy zaměňují jako synonyma, ale lze je rozlišit podle jejich dosahu. Dovednost se obvykle vztahuje na používání metod nebo přístrojů v určitém prostředí a ve vztahu k definovaným úkolům. Kompetence je širší termín a většinou se vztahuje ke schopnosti člověka – čelícího novým situacím a nepředvídaným výzvám – použít a aplikovat své znalosti a dovednosti samostatně a na základě vlastního rozhodnutí.

Stručně:
- **Znalosti = teoretické, praktické, profesní, průmyslové...**
- **Dovednosti = kognitivní, praktické, sociální... Dovednosti = vědět, jak...**
- **Kompetence = založené na úkolu, profesní, procedurální, sociální, osobní... Kompetence = sociální a vlastní**

Obecné zelené dovednosti

K obecným zeleným dovednostem patří znalosti, dovednosti a kompetence (ZDK) nezbytné k sociálnímu, ekonomickému a environmentálnímu vývoji v dřevozpracujícím nábytkářském průmyslu. Díky těmto obecným zeleným dovednostem můžeme přispět k „zezelenání" sektoru a podpořit přitom transformaci ekonomiky z lineární na cirkulární. Je proto nezbytné vytvořit zelenou, ekologickou mentalitu k minimalizování dopadů na životní prostředí během celého životního cyklu výrobků.

Dr. Margarita Pavlova roztřídila **obecné zelené dovednosti do čtyř kategorií**, které jsou povinné pro všechna povolání nehledě na svou úroveň a sladěné s klíčovými dovednostmi, zásadními pro moderní pracovní sílu. Tyto měkké dovednosti tu jsou uvedeny do kontextu v rámci environmentální informovanosti a porozumění udržitelnému vývoji a oběhovému hospodářství.

- **kognitivní kompetence** (1 až 3)
- **mezilidské kompetence** (4 až 9)
- **mezilidské kompetence** (10 a 11)
- **technické kompetence** (12 až 14)

Ve studii SAWYER používáme tyto obecné zelené dovednosti v následujícím kontextu:

- **Environmentální informovanost a ochota se učit**: o udržitelném rozvoji a cirkulární ekonomice.
- **Dovednosti týkající se systémů a analýz rizik** k vyhodnocení, výkladu a pochopení jak potřeby změn z lineární na cirkulární ekonomiku, tak konkrétních opatření nutných k tomuto přechodu.
- **Dovednosti týkající se inovací** ke zjišťování příležitostí a vytvoření nových strategií k reagování na „zelené" problémy související s oběhovým hospodářstvím.
- **Koordinační, manažerské a obchodní dovednosti** k podpoře holistického a interdisciplinárního přístupu začleňujícího hospodářské, společenské a ekologické cíle do organizace, ale také do hodnotového řetězce výrobku.
- **Komunikační a vyjednávací schopnosti** k debatování o konfliktních zájmech ve složitých situacích souvisejících s hodnotovým řetězcem výrobku.
- **Marketingové dovednosti** na podporu zelenějších výrobků a služeb a sdělování a šíření výhod strategií cirkulární ekonomiky.
- **Strategické a vedoucí schopnosti**, aby mohli tvůrci zásad a obchodní ředitelé vytvářet ty správné podněty a podmínky umožňující čistší výrobu, čistší dopravu atd. a propagovat oběhové hospodářství všeobecně.
- **Poradenské schopnosti** k poskytování rad zákazníkům o zelených řešeních a k širšímu používání zelených technologií a strategií cirkulární ekonomiky.
- **Dovednosti týkající se networkingu, informačních technologií a jazykové dovednosti** k umožnění působení na globálních trzích a v hodnotovém řetězci výrobku.
- **Přizpůsobitelnost a schopnost přenášet dovednosti**, aby se pracovníci naučili a uplatňovali nové technologie a procesy nutné k „zezelenání" jejich pracovních míst a strategie cirkulární ekonomiky.
- **Podnikatelské schopnosti** k uchopení příležitostí souvisejících s nízkouhlíkovými technologiemi a modely oběhového hospodářství pro produkty a služby.
- **Kvantifikace a monitorování** odpadů, energie a vody ke sledování vývoje výkonnostních ukazatelů cirkulární ekonomiky.
- Kvantifikace a monitorování **používaných materiálů a jejich dopadu** u zadávání zelených zakázek a výběru.
- **Minimalizace** používaných materiálů a jejich dopadu (vyhodnocení dopadu) s přihlédnutím k celému životního cyklu materiálu.

Uvádíme zde, zda mají tyto obecné zelené dovednosti dopad (či nikoli) na cílené profily ESCO a v jaké míře.

Technické zelené dovednosti

U některých profilů povolání budou vyžadovány nové zelené dovednosti, protože budou existovat nové, specifické úkoly související s demontáží a opětovným využitím, repasováním, recyklováním a upcyklací. Tyto nové dovednosti jsou zvlášť důležité pro „praktické" profily zaměstnání jako truhlář, čalouník nebo seřizovač/ obsluha dřevoobráběcích strojů, ale také pro pomocné pracovníky a obsluhu strojů a zařízení na zpracování dřeva. Některé obecné zelené kompetence nebudou tak silně zastoupeny u profilů v managementu, marketingu a komunikacích.

Nové specifické technické zelené dovednosti:

- Demontáž nábytkářských výrobků ze dřeva,
- Prostudování demontovaných dílů k dalším krokům (opětovnému využití, repasování, recyklaci, upcyklaci),
- Oprava dílů dřevěného nábytku tam, kde je to potřeba.

Tyto dovednosti završují stávající nezbytné ZDK pro výše uvedené profily povolání.

Nové zelené dovednosti budou mít také vliv, i když ne tak výrazný, na ty profily, které řídí a provádějí strategická rozhodnutí ve společnostech. U analyzovaných profilů ESCO máme na mysli obchodní a marketingové manažery, manažery průmyslové výroby, manažery dodavatelského řetězce a samozřejmě i návrháře nábytku.

Profily povolání: současné a předvídané změny na rok 2030

Tento oddíl zprávy obsahuje podrobnosti o očekávaných změnách v **dřevozpracujícím nábytkářském průmyslu** následkem přechodu na cirkulární ekonomiku (zeleně na r. 2030) a digitalizaci (modře na r. 2025): **aktualizované úkoly** vybraných profilů povolání, **stávající a nová rizika BOZP** a nezbytné **aktualizované dovednosti, znalosti a kompetence**. Jsou prezentovány pomocí specifických tabulek zaměřených na jednotlivé aspekty.

Ve všech následujících tabulkách jsme na text použili modrou barvu k vyznačení jakýchkoli změn oproti současné situaci ohledně digitalizace odvětví a zelenou barvu u změn v důsledku transformace sektoru na oběhové hospodářství.

Změny v úkolech

Současné úkoly a předvídané změny v úkolech jednotlivých profilů povolání následkem přechodu na cirkulární ekonomiku a digitalizace. **První sloupec** vlevo v těchto zelených tabulkách obsahuje detailní popis **současných/aktualizovaných úkolů** jednotlivých profilů (v r. 2020). Sloupce a buňky uprostřed uvádějí úkoly ovlivněné jednotlivými zásadami ReSOLVE. V **posledním sloupci** napravo je uvedena **prognóza změn v úkolech** následkem digitalizace sektoru do r. 2025 modře a transformace na cirkulární ekonomiku do r. 2030 zeleně.

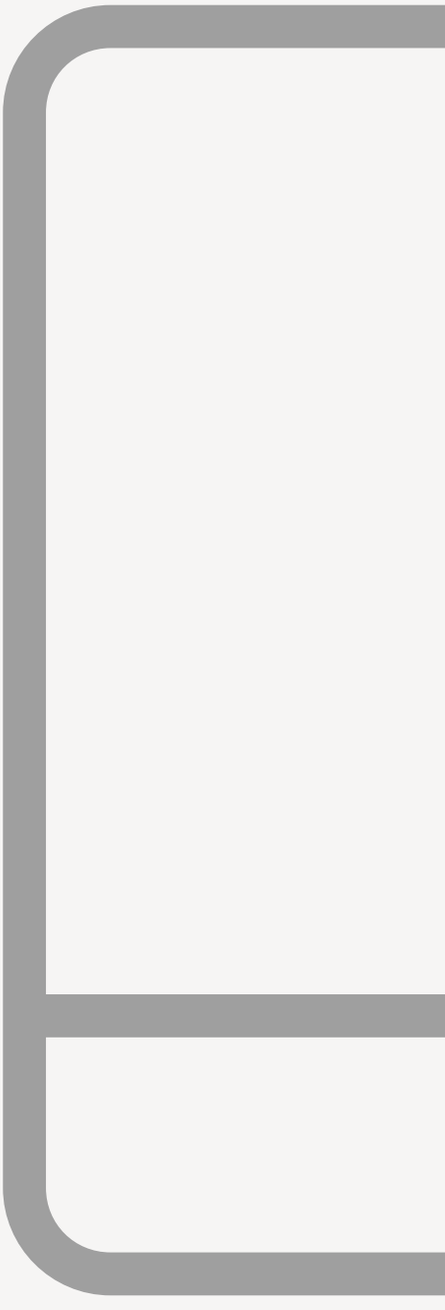
Změny v rizikách a nebezpečích

Současná rizika a předvídané změny rizik u jednotlivých profilů povolání následkem digitalizace.
V těchto žlutých tabulkách se první a poslední sloupec shoduje s předchozími tabulkami se změnami v úkolech. Buňky uprostřed představují prognózu **nové kategorizace nebezpečí** – šedá barva označuje ty, které se nemají měnit, zelená označuje nižší nebezpečí díky cirkulární ekonomice, červená nová nebo vyšší nebezpečí vzhledem k cirkulární ekonomice, modrá nižší nebezpečí díky digitalizaci a žlutá vyšší nebezpečí následkem digitalizace. Oddíl po této tabulce obsahuje podrobný soupis **současných nebezpečí a rizik a očekávaných změn** následkem přechodu odvětví na cirkulární ekonomiku (zeleně na r. 2030) a digitalizace (modře na r. 2025).

Nezbytné dovednosti a kompetence

Prognóza nových potřeb školení následkem přechodu sektoru na oběhové hospodářství (zeleně na r. 2030) a digitalizace (modře na r. 2025) pro jednotlivé profily.

V těchto tabulkách najdete v levém sloupci seznam **současných a nově potřebných dovedností, znalostí a kompetencí** včetně obecných zelených. Druhý sloupec uvádí, zda budou pro jednotlivé profily ZDK aktualizované (ANO, změněné), stále potřebné (ANO nebo NE), nové (NOVÉ) nebo zda nepřísluší (NA). V posledních sloupcích napravo, jejichž počet a obsah se u jednotlivých profilů liší, jsou uvedeny **důvody ke změně** u každé ZDK: zelené body značí, že ke změně dochází vzhledem k přechodu na cirkulární ekonomiku, a modré body ukazují na digitalizaci odvětví.



Sales and marketing manager ISCO 1221

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.

Sales and marketing manager ISCO 1221

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

Sales and marketing manager ISCO 1221

2020
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 profiles tasks		ReSOLVE levers*																							
		Regenerate	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste	
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.		●	●	●				●	●	●	●		●	●	●	●	●		●	●	●	●		

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Sales and marketing manager - ISCO 1221

2025/30
Occupational profile

Description forecast of the occupational profile in 2030
Sales and marketing managers plan, direct and coordinate the sales and marketing activities of highly digitized and circular economy-oriented enterprises or organizations, or of enterprises that provide sales and marketing services to other digitized and circular economy-oriented enterprises and organizations. Use digitization tools and circular economy-oriented strategies to work in a customer-oriented manner.

	Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services		**Profile tasks forecast**
		●	●		●	●	●	A	Planning and organizing special sales and marketing programmes based on connected customers ecosystem, sales records, and global digitized market assessments and considering the circular economy-oriented strategies of the organisation and its customers.
		●	●				●	B	Determining price lists, discount and delivery terms, sales promotion budgets, sales methods, special incentives and campaigns using digitized inputs from customer ecosystems, including customers' sustainability needs and requirements on products and services, and a globally connected distribution and marketing network.
		●	●				●	C	Establishing and directing digitized operational and administrative procedures related to sales and marketing activities, aligned with the organisation's strategies and customers demands on sustainability.
		●	●				●	D	Leading and managing the activities of sales and marketing staff in highly digitized and circular economy-oriented organizations, motivating and engaging the staff on organisation sustainability strategies.
		●	●				●	E	Planning and directing daily (sales and marketing) operations within a highly digitized entreprise-customer ecosystem and alligned with the circular economy-oriented strategies of the customers and the organisation.
		●	●				●	F	Establishing and managing budgets and controlling expenditure to ensure the efficient use of resources in a fully connected and digitized system, meeting the customers' expectations on sustainability (and other issues).
		●	●			●	●	G	Overseeing the selection, training and performance of staff exploiting tools and instruments of an highly connected and digitized company, promoting circular economy competences and skills.
		●	●		●	●	●	H	Representing the enterprise or organization at sales and marketing conventions, trade exhibitions, in online platforms and other face-to-face or virtual forums, communicating the circular economy-oriented strategies of the organisation and other sustainability aspects of the products and services.

Sales and marketing manager ISCO 1221

2020
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.

New categorization of hazards

Current profiles tasks		**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	Laserlight	**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)	Recycled material	**Biological Hazards**	Non-targeted activities with microorganism	**Psychosocial hazards**	Excessive workloads	Low job satisfaction	Work tasks not clearly defined	
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.						●						●										●	●											●		●	

● No changes ● Reduced due to Circular Economy ● New or increased due to Circular Economy ● Reduced due to digitalization ● New or increased due to digitalization

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Sales and marketing manager - ISCO 1221

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Sales and marketing managers plan, direct and coordinate the sales and marketing activities of highly digitized and circular economy-oriented enterprises or organizations, or of enterprises that provide sales and marketing services to other digitized and circular economy-oriented enterprises and organizations. Use digitization tools and circular economy-oriented strategies to work in a customer-oriented manner.

	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 tasks forecast**
A	●	●		●	●	●	●		●	●	●	Planning and organizing special sales and marketing programmes based on connected customers ecosystem, sales records, and global digitized market assessments and considering the circular economy-oriented strategies of the organisation and its customers.
B	●	●		●	●	●	●		●	●	●	Determining price lists, discount and delivery terms, sales promotion budgets, sales methods, special incentives and campaigns using digitized inputs from customer ecosystems, including customers' sustainability needs and requirements on products and services, and a globally connected distribution and marketing network.
C	●	●		●	●	●	●		●	●	●	Establishing and directing digitized operational and administrative procedures related to sales and marketing activities, aligned with the organisation's strategies and customers demands on sustainability.
D	●	●		●	●	●	●		●		●	Leading and managing the activities of sales and marketing staff in highly digitized and circular economy-oriented organizations, motivating and engaging the staff on organisation sustainability strategies.
E	●	●		●	●	●	●		●	●	●	Planning and directing daily (sales and marketing) operations within a highly digitized entreprise-customer ecosystem and alligned with the circular economy-oriented strategies of the customers and the organisation.
F	●	●		●	●	●	●		●	●	●	Establishing and managing budgets and controlling expenditure to ensure the efficient use of resources in a fully connected and digitized system, meeting the customers' expectations on sustainability (and other issues).
G	●	●		●	●	●	●		●		●	Overseeing the selection, training and performance of staff exploiting tools and instruments of an highly connected and digitized company, promoting circular economy competences and skills.
H	●	●		●	●	●	●		●		●	Representing the enterprise or organization at sales and marketing conventions, trade exhibitions, in online platforms and other face-to-face or virtual forums, communicating the circular economy-oriented strategies of the organisation and other sustainability aspects of the products and services.

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Sales and marketing manager - ISCO 1221

2020 Current situation	2025-30 Situation forecast
Work system/work area: office work, business trips, visits to trade fairs, contact with business partners and clients.	Work system/work area: office work, business trips, visits to trade fairs, contact with business partners and clients. Use of innovative software and tools. Taking into account sustainable products and production lines, circular-economy and renewable energy.
Mechanical hazards	
• Slips and trips, obstacles, table edges, moving vehicles, machines. **Effects:** squeezing, cutting, twisting, spraining, bumps and bruises.	• Slips and trips, obstacles, table edges, moving vehicles, machines. **Effects**: squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: from poor ergonomic conditions and inactivity. **Effects**: musculoskeletal diseases, overweight, cardiovascular problems.	• Ergonomic hazards: from poor ergonomic conditions and inactivity. Digitalization 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. **Effects**: musculoskeletal diseases, overweight, cardiovascular problems.
Electrical hazards	
• Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices). **Effect**: fatal accident.	• Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices). **Effect**: fatal accident.
Work environmental hazards	
• Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. **Effects**: eyestrain, headache, colds, cardiovascular problems.	• Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. **Effects**: eyestrain, headache, colds, cardiovascular problems.
Psychosocial hazards	
• Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information.	• Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information, increased demand on flexibility. Excessive workload: involved in the implementation/transition of industrial production towards circular economy. • 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. Deciding on circular economic and sustainable oriented strategies/products/marketing projects: increased demand on skills and knowledge/keeping up-to-date regarding the current development in circular economy and sustainable oriented strategies/products/marketing projects (staying up-to-date; further training for new technologies and processes).
• Social relationship: difficult clients, difficult colleagues.	• Social relationship: difficult clients, difficult colleagues, lack of social contacts.
• Working method: Frequent contacts with customers, cooperation with other departments. Use of simple software and CRM. **Effects**: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.	• 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. Increased demand on flexibility: need of knowledge concerning recycling, sustainable materials and products. **Effects**: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders, cognitive strain, stress due to long period of concentration and information overload.

Skills and competences needs

Forecast of training new needs due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Sales and marketing manager - ISCO 1221

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Virtualise direct aspects of the product	Virtualise indirect aspects of the product	Choose new products and services	Use digitization tools to work in a customer-oriented manner	Using digitalized input from customer ecosystems and a globally connected distribution and marketing network	Working within a highly digitalized enterprise-customer ecosystem	Working in a fully connected and digitalized 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, changed	●	●					
Project management	YES							
Risk management	YES, changed			●		●		●
Generic green skills, knowledge and competences (*)								
Environmental awareness and willingness to learn	NEW			●				
Systems and risk analysis skills	NEW			●				
Innovation skills	NEW			●				
Coordination, management and business skills	NEW			●				
Communication and negotiation skills	NEW	●	●	●				
Marketing skills	NEW	●	●	●				
Strategic and leadership skills	NA							
Consulting skills	NEW	●	●	●				
Networking, information technology and language skills	NEW	●	●	●				
Adaptability and transferability skills	NEW	●	●	●				
Entrepreneurial skills	NEW			●				
Waste, energy and water quantification and monitoring	NA							
Material use and impact quantification and monitoring	NEW		●					
Material use and impact minimisation	NA							

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

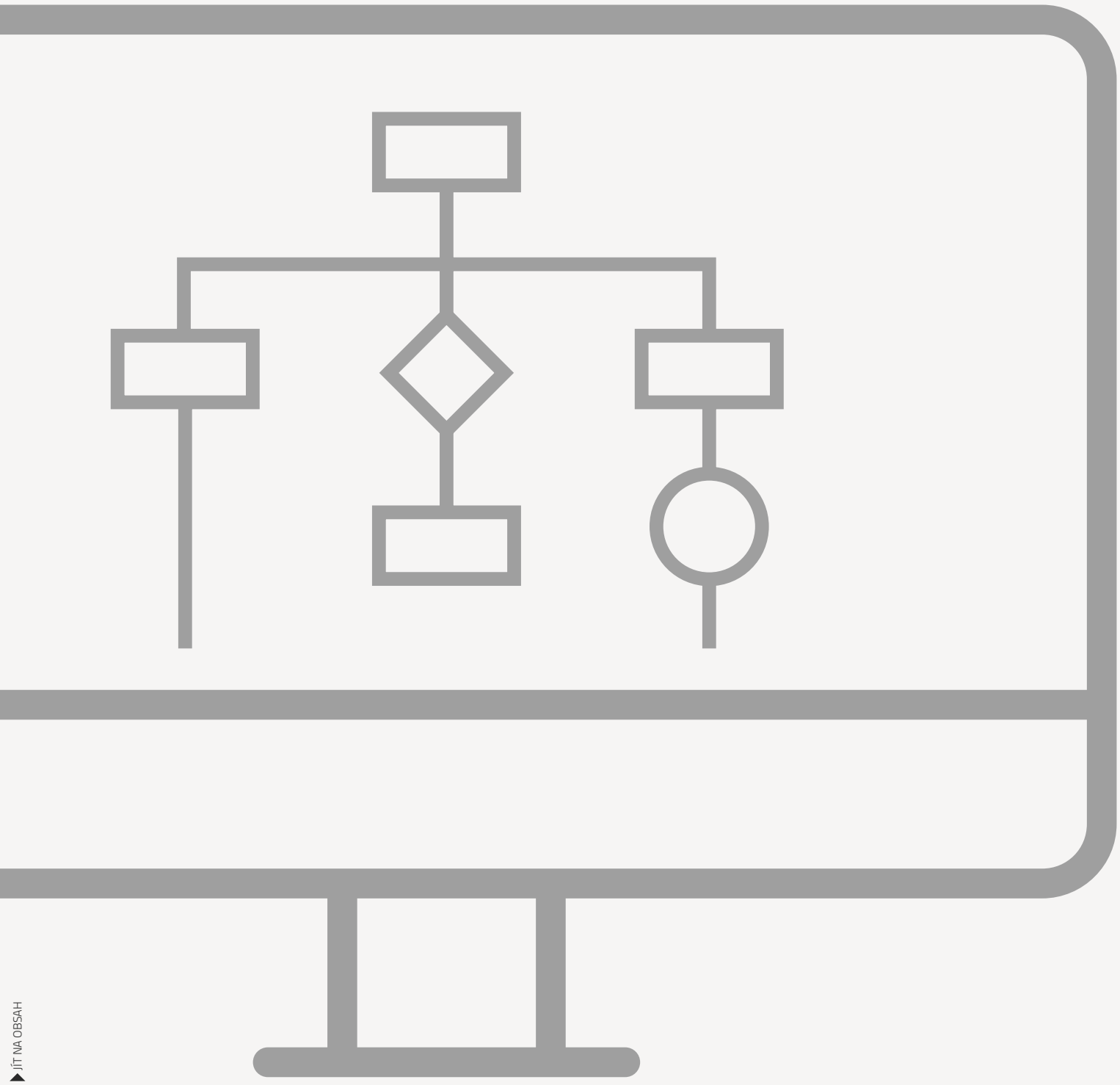
Industrial production manager
ISCO 1321s

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.



Industrial production manager
ISCO 1321s

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

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Industrial production manager ISCO 1321s

2020
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 profiles tasks		ReSOLVE levers*																						
		Regenerate	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste	
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.		●	●										●	●	●	●	●				●			
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.		●	●				●	●	●	●	●		●	●	●	●	●		●	●	●	●		

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Industrial production manager - ISCO 1321s

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Industrial production managers oversee the operations and the resources needed in highly digitised and ecoefficient industrial plants and manufacturing sites for a smooth running of the operations. Supported by data and instruments of highly digitized systems and following circular economy-oriented strategies, they prepare the production schedule by combining the technical & sustainability 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 and circular economy-oriented strategies to work in a customer-oriented manner.

	Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	**Profile tasks forecast**
A		●	●		●	●	●	Determining, implementing and monitoring production strategies, policies and plans exploiting the possibilities of a highly digitised manufacturing plant and considering the circular economy-oriented strategies of the organisation.
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 and in terms of reducing their environmental impact and the application of circular economy opportunities, such as waste reduction.
C		●				●		Controlling the operation of a highly digitised, lean and ecoefficient production plant including handling of quality procedures and sustainability work practices & policies 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 and environmental impacts in a highly connected digital manufacturing chain which applies sustainable technologies and practices.
E		●	●		●	●	●	Securing distribution of information of all production matters to other managers as part of digital performance and sustainability-oriented management as well as consultations with other managers in general and the sustainability manager in specific.
F		●	●		●	●	●	Overseeing the acquisition and installation of highly digitised and ecoefficient new plants and equipment, following the sustainability strategies of the organisation and green procurement criteria.
G		●			●	●		Securing the preparation of fully integrated and digitised production records and reports, including sustainability performance indicators associated to the manufacturing plant.
H		●			●	●	●	Coordinating the implementation of occupational health and safety requirements and other environmental requirements such as hazardous substances use, as part of the highly integrated digital enterprise ecosystem.
I		●	●		●	●	●	Identifying business opportunities and circular economy business models and determining smart (digital) and eco-designed products to be manufactured in an extremely digitised and low environmental impact manufacturing ecosystem.
J					●	●		Researching and implementing regulatory and statutory requirements affecting highly digitised manufacturing operations, the environment and the general company ecosystem, including environmental regulations on products and processes.
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, taking into account green procurement criteria and boosting the traction of the supply chain on sustainability.
L		●	●		●	●	●	Overseeing the selection, training and performance of staff exploiting tools and instruments of an highly connected and digitized company, promoting circular economy-oriented competences and skills.

Industrial production manager ISCO 1321s

2020
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.

New categorization of hazards

Current profiles tasks		**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	Laserlight	**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)	Recycled material	**Biological Hazards**	Non-targeted activities with microorganism	**Psychosocial hazards**	Excessive workloads	Low job satisfaction	Work tasks not clearly defined
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.												●		●								●	●										●		●
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 ● Reduced due to Circular Economy ● New or increased due to Circular Economy ● Reduced due to digitalization ● New or increased due to digitalization

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Industrial production manager - ISCO 1321s

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Industrial production managers oversee the operations and the resources needed in highly digitised and ecoefficient industrial plants and manufacturing sites for a smooth running of the operations. Supported by data and instruments of highly digitized systems and following circular economy-oriented strategies, they prepare the production schedule by combining the technical & sustainability 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 and circular economy-oriented strategies to work in a customer-oriented manner.

	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 tasks forecast**
A	●	●		●	●	●	●		●	●	●	Determining, implementing and monitoring production strategies, policies and plans exploiting the possibilities of a highly digitised manufacturing plant and considering the circular economy-oriented strategies of the organisation.
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 and in terms of reducing their environmental impact and the application of circular economy opportunities, such as waste reduction.
C	●	●		●	●	●	●		●	●	●	Controlling the operation of a highly digitised, lean and ecoefficient production plant including handling of quality procedures and sustainability work practices & policies 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 and environmental impacts in a highly connected digital manufacturing chain which applies sustainable technologies and practices.
E	●	●		●	●	●	●		●		●	Securing distribution of information of all production matters to other managers as part of digital performance and sustainability-oriented management as well as consultations with other managers in general and the sustainability manager in specific.
F	●	●		●	●	●	●		●		●	Overseeing the acquisition and installation of highly digitised and ecoefficient new plants and equipment, following the sustainability strategies of the organisation and green procurement criteria.
G	●	●		●	●	●	●		●	●	●	Securing the preparation of fully integrated and digitised production records and reports, including sustainability performance indicators associated to the manufacturing plant.
H	●	●		●	●	●	●		●	●	●	Coordinating the implementation of occupational health and safety requirements and other environmental requirements such as hazardous substances use, as part of the highly integrated digital enterprise ecosystem.
I	●	●		●	●	●	●		●	●	●	Identifying business opportunities and circular economy business models and determining smart (digital) and eco-designed products to be manufactured in an extremely digitised and low environmental impact manufacturing ecosystem.
J	●	●		●	●	●	●		●	●	●	Researching and implementing regulatory and statutory requirements affecting highly digitised manufacturing operations, the environment and the general company ecosystem, including environmental regulations on products and processes.
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, taking into account green procurement criteria and boosting the traction of the supply chain on sustainability.
L	●	●		●	●	●	●		●	●	●	Overseeing the selection, training and performance of staff exploiting tools and instruments of an highly connected and digitized company, promoting circular economy-oriented competences and skills.

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Industrial production manager - ISCO 1321s

2020 Current situation	2025-30 Situation forecast
Work system/work area: office work, use of software, inspection of production facilities and machines, contact with clients.	Work system/work area: office work, use of software, inspection of production facilities and machines, contact with clients, use of digitalized equipment and systems; implementation of industrial production towards circular-economy and use of renewable energy; being in charge of new production lines such as recycling, disassembling, and repair of furniture.
Mechanical hazards	
• Slips and trips, obstacles, table edge, Safety hazards/accidents due to unknown workplaces, travelling and setting up stands. **Effects:** squeezing, cutting, twisting, spraining, bumps and bruises.	• Slips and trips, obstacles, table edge, Safety hazards/accidents due to unknown workplaces, travelling and setting up stands. **Effects:** squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: from poor ergonomic conditions and inactivity. **Effects**: musculoskeletal diseases, overweight, cardiovascular problems.	• Ergonomic hazards: from poor ergonomic conditions and inactivity. Digitalization 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. **Effects**: musculoskeletal diseases, overweight, cardiovascular problems.
Electrical hazards	
• Electrical hazards: contacts with live parts, defective cables (computer and other electric devices). **Effect**: fatal accident.	• Electrical hazards: contacts with live parts, defective cables (computer and other electric devices). **Effect**: fatal accident.
Work environmental hazards	
• Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. **Effects**: eyestrain, headache, colds, cardiovascular problems**.**	• Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature. **Effects**: eyestrain, headache, colds, cardiovascular problems.
Psychosocial hazards	
• Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information, increased demand on flexibility.	• Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information, increased demand on flexibility. Excessive workload: involved in the implementation/transition of industrial production towards circular economy. • Lack of work experiences: New software and digital devices require training, some workers may not have enough competences and may feel overloaded, not experienced enough. Deciding on circular economic and sustainable oriented strategies/products/marketing projects: increased demand on skills and knowledge/keeping up-to-date regarding the current development in circular economy and sustainable oriented strategies/products/marketing projects (staying up-to-date; further training for new technologies and processes).
• Social relationship: difficult clients, difficult colleagues.	• Social relationship: difficult clients, difficult colleagues, lack of social contacts.
• 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.	• Working method: digital equipment, cognitive interactions between autonomous techniques and virtual reality, virtual conferences. 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. Increased demand on flexibility: need of knowledge and skills concerning recycling, disassembly and remanufacture operations as well as in use of renewable energy.
Effects: stress: burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.	**Effects**: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders, cognitive strain, stress due to long period of concentration and information overload.

Skills and competences needs

Forecast of training new needs due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Industrial production manager - ISCO 1321s

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Shift to renewable energies	Shift to renewable materials	Increase performance/ efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	Remanufacture products and/or components	Recycle materials	Apply new technologies	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, changed	●	●	●	●	●	●	●	●	●	●					
Adjust production schedule	YES, changed											●	●	●		
Assess impact of industrial activities	YES, changed	●	●	●			●	●		●	●	●	●	●		
Check material resources	YES, changed	●	●	●			●	●	●	●	●	●	●	●		
Control financial resources	YES, changed	●	●	●			●	●		●						
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, changed	●	●	●			●	●	●	●						
Essential knowledge																
Industrial health and safety measures	YES, changed	●	●	●			●	●	●	●						
Industrial engineering	YES, changed	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Manufacturing processes	YES, changed	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Generic green skills, knowledge and competences (*)																
Environmental awareness and willingness to learn	NEW	●	●	●			●	●	●	●	●					
Systems and risk analysis skills	NEW	●	●	●			●	●	●	●						
Innovation skills	NEW	●	●	●	●	●	●	●	●	●	●					
Coordination, management and business skills	NEW	●	●	●	●	●	●	●	●	●	●					
Communication and negotiation skills	NEW	●	●	●	●		●	●		●	●					
Marketing skills	NA															
Strategic and leadership skills	NEW	●	●	●	●	●	●	●	●	●	●					
Consulting skills	NA															
Networking, information technology and language skills	NEW	●	●	●	●	●		●	●		●					
Adaptability and transferability skills	NEW	●	●	●	●	●	●	●	●	●	●					
Entrepreneurial skills	NEW			●			●	●	●	●	●					
Waste, energy and water quantification and monitoring	NEW	●		●		●	●	●			●					
Material use and impact quantification and monitoring	NEW		●	●	●	●	●	●	●	●	●					
Material use and impact minimisation	NEW		●	●	●	●	●	●	●	●	●					

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

Supply chain manager ISCO 1324s

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.

Supply chain manager ISCO 1324s

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

Supply chain manager
ISCO 1324s

2020
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 profiles tasks	**Regenerate**	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste	
		ReSOLVE levers*																							
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.		●	●				●	●	●	●	●			●	●	●	●		●	●	●	●	●	

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Supply chain manager - ISCO 1324s

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Supply chain managers plan, manage and coordinate all activities related to the sourcing and procurement of supplies needed to run manufacturing operations from the preferable acquisition of sustainable raw materials to the distribution of ecodesigned finished products with the support of updated and continuous data collected in an highly connected, circular economy-oriented and digitized company system. The supplies can be sustainable raw materials or finished products (including reused/recovered or remanufactured products), and it can be for internal or external use. Moreover, they plan and commission all the activities needed to be performed in ecoefficient manufacturing plants and adjust operations to changing levels of demand for a company's sustainable product. Use digitization tools and circular economy-oriented strategies to work in a customer-oriented manner.

Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	**Profile tasks forecast**
	●	●		●	●	●	A Determining, implementing and monitoring environmentally friendly purchasing, storage and distribution strategies, policies and plans of the digitised ecosystem, aligned with the circular economy-oriented strategies of the organisation.
	●	●		●	●	●	B Preparing and implementing plans to maintain required stock levels of the highly digitised enterprise ecosystem at minimum cost and with minimal environmental impact.
	●	●		●	●	●	C Negotiating fair contracts with suppliers to meet quality, environmental, cost and delivery requirements of the highly digitised enterprise ecosystem, applying green purchasing criteria and boosting a sustainable supply chain.
	●	●		●	●	●	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, and alligned with the sustainability strategies of the organisation.
	●	●		●	●	●	E Overseeing the dispatch of road vehicles, trains, vessels or aircraft, selecting preferably the most environmentaly friendly alternative and promoting a sustainable supply chain, 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, analysing the environmental impact associated to the logistics of the raw materials and products.
	●	●		●	●	●	G Liaising with other departments and customers concerning requirements for outward goods and associated forwarding transportation, aligned with the circular economy-oriented strategies of the organisation (for example sustainable source of materials) and 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 and ecoefficient factory ecosystem.
	●	●		●	●	●	I Establishing and managing budgets, controlling expenditure and ensuring the efficient use of resources as integrated part of the highly interconnected, circular economy-oriented and digitised company ecosystem, meeting the customers' needs and expectations on sustainability (and other issues) and boosting the traction of the supply chain on sustainability.
	●	●		●	●	●	J Establishing and directing operational and administrative procedures in the highly digitised company ecosystem, aligned with the organisation strategies and customers' demands on sustainability.
	●	●		●	●	●	K Planning and directing daily operations both physically and digitally using the connected cloud and considering the environmental impact of these operations.
	●	●		●	●	●	L Overseeing the selection, training and performance of staff exploting tools and instruments of a highly connected and digitized company, promoting circular-economy-oriented competences and skills.

Supply chain manager
ISCO 1324s

2020
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.

New categorization of hazards

Current profiles tasks		**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	Laserlight	**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)	Recycled material	**Biological Hazards**	Non-targeted activities with microorganism	**Psychosocial hazards**	Excessive workloads	Low job satisfaction	Work tasks not clearly defined
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.												●										●	●										●		●

● No changes ● Reduced due to Circular Economy ● New or increased due to Circular Economy ● Reduced due to digitalization ● New or increased due to digitalization

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Supply chain manager - ISCO 1324s

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Supply chain managers plan, manage and coordinate all activities related to the sourcing and procurement of supplies needed to run manufacturing operations from the preferable acquisition of sustainable raw materials to the distribution of ecodesigned finished products with the support of updated and continuous data collected in an highly connected, circular economy-oriented and digitized company system. The supplies can be sustainable raw materials or finished products (including reused/recovered or remanufactured products), and it can be for internal or external use. Moreover, they plan and commission all the activities needed to be performed in ecoefficient manufacturing plants and adjust operations to changing levels of demand for a company's sustainable product. Use digitization tools and circular economy-oriented strategies to work in a customer-oriented manner.

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 tasks forecast**
●	●		●	●	●	●		●		●	A	Determining, implementing and monitoring environmentally friendly purchasing, storage and distribution strategies, policies and plans of the digitised ecosystem, aligned with the circular economy-oriented strategies of the organisation.
●	●		●	●	●	●		●	●	●	B	Preparing and implementing plans to maintain required stock levels of the highly digitised enterprise ecosystem at minimum cost and with minimal environmental impact.
●	●		●	●	●	●		●		●	C	Negotiating fair contracts with suppliers to meet quality, environmental, cost and delivery requirements of the highly digitised enterprise ecosystem, applying green purchasing criteria and boosting a sustainable supply chain.
●	●		●	●	●	●		●		●	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, and alligned with the sustainability strategies of the organisation.
●	●		●	●	●	●		●	●	●	E	Overseeing the dispatch of road vehicles, trains, vessels or aircraft, selecting preferably the most environmentaly friendly alternative and promoting a sustainable supply chain, 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, analysing the environmental impact associated to the logistics of the raw materials and products.
●	●		●	●	●	●		●		●	G	Liaising with other departments and customers concerning requirements for outward goods and associated forwarding transportation, aligned with the circular economy-oriented strategies of the organisation (for example sustainable source of materials) and 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 and ecoefficient factory ecosystem.
●	●		●	●	●	●		●	●	●	I	Establishing and managing budgets, controlling expenditure and ensuring the efficient use of resources as integrated part of the highly interconnected, circular economy-oriented and digitised company ecosystem, meeting the customers' needs and expectations on sustainability (and other issues) and boosting the traction of the supply chain on sustainability.
●	●		●	●	●	●		●	●	●	J	Establishing and directing operational and administrative procedures in the highly digitised company ecosystem, aligned with the organisation strategies and customers' demands on sustainability.
●	●		●	●	●	●		●		●	K	Planning and directing daily operations both physically and digitally using the connected cloud and considering the environmental impact of these operations.
●	●		●	●	●	●		●		●	L	Overseeing the selection, training and performance of staff exploting tools and instruments of a highly connected and digitized company, promoting circular-economy-oriented competences and skills.

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Supply chain manager - ISCO 1324s

2020 Current situation	2025-30 Situation forecast
Work system/work area: office work, business trips, contact with clients and business partners, use of complex software.	Work system/work area: office work, business trips, contact with clients and business partners, use of complex software, use of digitalized tools and circular economy-oriented strategies.
Mechanical hazards	
• Slips and trips, obstacles, table edges.	• Slips and trips, obstacles, table edges.
Effects: squeezing, cutting, twisting, spraining, bumps and bruises.	**Effects:** squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: from poor ergonomic conditions and inactivity.	• Ergonomic hazards: from poor ergonomic conditions and inactivity. Digitalization 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.
Effects: musculoskeletal diseases, overweight, cardiovascular problems.	Effects: musculoskeletal diseases, overweight, cardiovascular problems.
Electrical hazards	
• Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices).	• Electrical hazards: contacts with live parts, defective cables (Computer and other electric devices).
Effect: fatal accident.	**Effect:** fatal accident.
Work environmental hazards	
• Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature.	• Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature.
Effects: eyestrain, headache, colds, cardiovascular problems.	**Effects:** eyestrain, headache, colds, cardiovascular problems.
Psychosocial hazards	
• Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information.	• Organisation of work/content of work: tight deadlines, performance pressure, high responsibility, overload, lack of training and information, increased demand on flexibility. Increased demand on competences and up-to-date knowledge on the current development in circular economy and recycling industry.
• Social relationship: difficult clients, difficult colleagues.	• Social relationship: difficult clients, lack of social contacts.
• 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.	• Working method: digital equipment, cognitive interactions with autonomous technologies and virtual reality, virtual conferences. Digitalization 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.
	• 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. Deciding on circular economic and sustainable oriented strategies/products/marketing projects: increased demand on skills and knowledge/keeping up-to-date regarding the current development in circular economy and sustainable oriented strategies/products/marketing projects (staying up-to-date; further training for new technologies and processes).
Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.	**Effects**: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders, cognitive strain, stress due to long period of concentration.

Skills and competences needs

Forecast of training new needs due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Supply chain manager - ISCO 1324s

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Shift to renewable energies	Shift to renewable materials	Customisation/made to order	Reproductible and adaptable manufacturing	Implement Take Back programs	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	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	YES, changed		●	●		●				●	●					
Manage supplies	YES, changed	●	●	●		●	●	●	●	●	●	●	●		●	●
Order supplies	YES, changed	●	●	●		●			●	●	●					
Strive for company growth	YES, changed	●	●	●	●	●	●	●	●	●	●	●	●		●	●
Essential knowledge																
Corporate social responsibility	YES, changed	●	●	●	●	●	●	●	●	●	●					
Supplier management	YES, changed	●	●	●		●			●	●	●	●	●			
Supply chain management	YES, changed	●	●	●		●			●	●	●				●	●
Supply chain principles	YES, changed	●	●	●		●			●	●	●					
Generic green skills, knowledge and competences (*)																
Environmental awareness and willingness to learn	NEW	●	●	●	●	●	●	●	●	●	●					
Systems and risk analysis skills	NEW	●	●	●		●			●	●	●					
Innovation skills	NEW	●	●	●					●	●	●					
Coordination, management and business skills	NEW	●	●	●	●	●			●	●	●					
Communication and negotiation skills	NEW	●	●	●	●	●			●	●	●					
Marketing skills	NEW	●	●	●		●	●	●	●	●	●					
Strategic and leadership skills	NEW	●	●	●						●	●					
Consulting skills	NA															
Networking, information technology and language skills	NEW	●	●	●		●			●	●	●					
Adaptability and transferability skills	NEW	●	●	●	●	●	●	●	●	●	●					
Entrepreneurial skills	NEW					●			●	●	●					
Waste, energy and water quantification and monitoring	NEW	●	●		●	●			●	●	●					
Material use and impact quantification and monitoring	NEW	●	●		●	●			●	●	●					
Material use and impact minimisation	NEW	●	●	●	●	●	●	●	●	●	●					

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

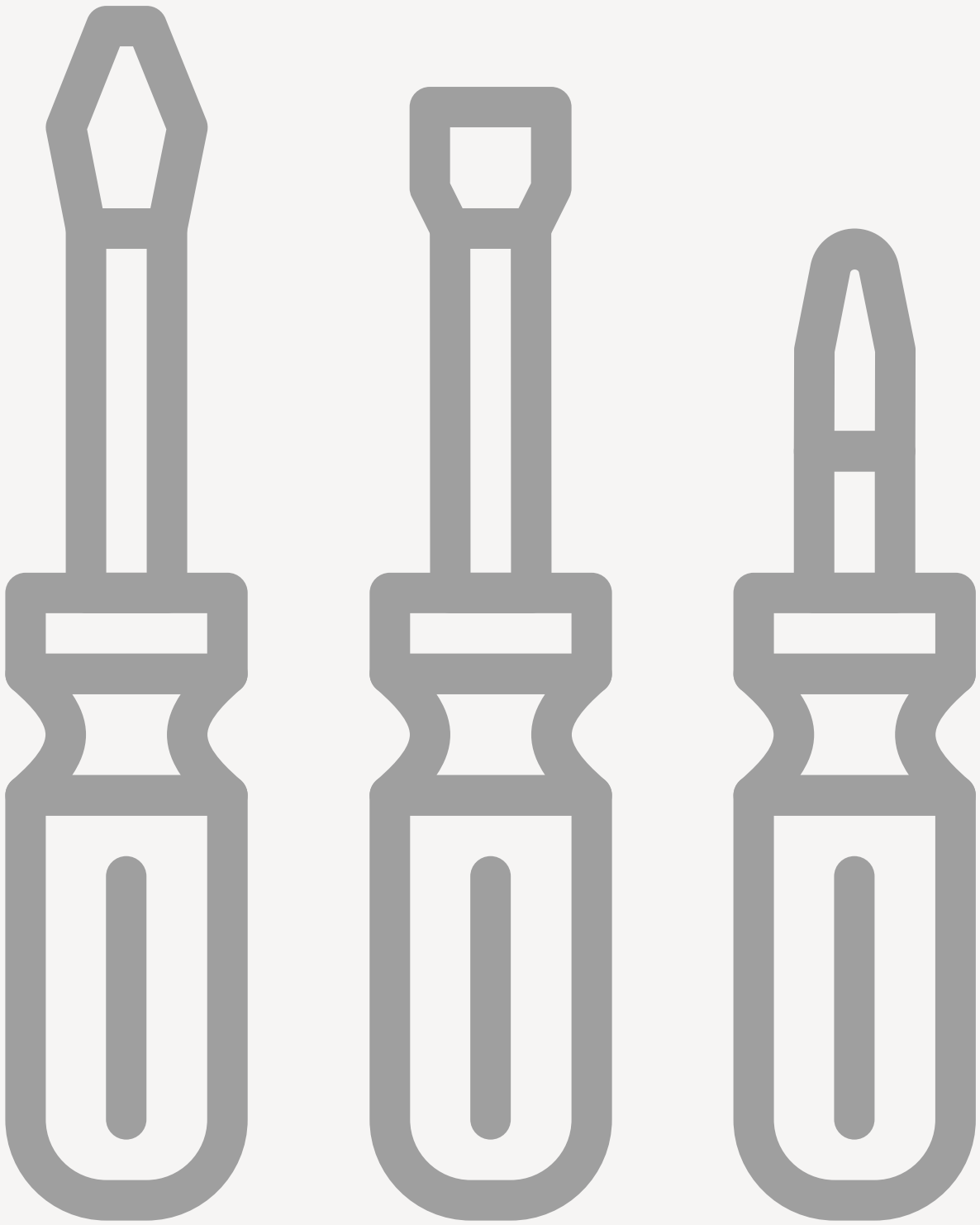
Maintenance & repair engineer ISCO 2141s

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.



Maintenance & repair engineer ISCO 2141s

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

Maintenance & repair engineer ISCO 2141s

2020
Occupational profile

Current profile description
Maintenance and repair engineers focus on the optimization of equipment, procedures, machineries and infrastructure. They ensure their maximum availability at minimum costs.
- 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 profiles tasks		ReSOLVE levers*																						
		Regenerate	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste
A	Establishing standards and policies for installation, modification, quality control, testing, inspection and maintenance according to engineering principles and safety regulations.		●	●										●	●	●	●	●				●	●	
B	Inspecting plant to improve and maintain performance.		●	●											●	●	●	●				●		
C	Directing the maintenance of plant buildings and equipment, and coordinating the requirements for new designs, surveys and maintenance schedules. **Preventive maintenance:** • 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...). • Plans, develops, executes approved modifications to the installation(s).		●	●											●	●	●	●				●		
D	Advising management on new production methods, techniques and equipment.		●	●										●	●	●	●	●			●	●		
E	Liaising with materials buying, storing and controlling departments to ensure a steady flow of supplies.		●	●											●	●	●	●				●		

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Maintenance & repair engineer - ISCO 2141s

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Maintenance and repair engineers focus on the optimization of equipment, procedures, machineries and infrastructure in a highly integrated digital ecosystem of the digital and ecoefficient manufacturing plant. They ensure their maximum availability at minimum costs and environmental impact.

- 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, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. waste generation or energy use reduction, recycling programs, green energy use, etc.).

Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services		**Profile tasks forecast**
		●		●	●	●	A	Establishing standards and policies for installation, modification, quality control, testing, inspection and maintenance according to engineering principles, sustainability-oriented strategies and safety regulations in a highly digitised and ecoefficient manufacturing plant ecosystem.
		●		●	●	●	B	Monitoring, inspection and digital registration of the plant to improve and maintain its technical and environmental performance (e.g. energy use, waste generation, air & water emissions, etc.).
		●		●	●	●	C	Directing the digital handling of the maintenance of plant buildings and equipment, and coordinating the requirements for new designs, surveys and maintenance schedules, aligned with the sustainability strategies of the organisation. **Preventive maintenance:** • 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). • Analyses how to reduce the environmental impact of the plant and proposes modifications.
	●	●		●	●	●	D	Advising management on new smarter and ecoefficient production methods, and best-available and digital techniques and equipment; considering the reduction of the environmental impact of the plant (e.g. reduction of raw materials, energy, waste, etc.).
		●		●	●	●	E	Liaising with materials purchasing, storing and controlling departments to ensure a steady flow of sustainable supplies within and around the entire digital ecosystem and following green purchasing criteria.

Maintenance & repair engineer ISCO 2141s

2020
Occupational profile

Current profile description
Maintenance and repair engineers focus on the optimization of equipment, procedures, machineries and infrastructure. They ensure their maximum availability at minimum costs.
- 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 profiles 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	Laserlight	**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)	Recycled material	**Biological Hazards**	Non-targeted activities with microorganism	**Psychosocial hazards**	Excessive workloads	Low job satisfaction	Work tasks not clearly defined
A	Establishing standards and policies for installation, modification, quality control, testing, inspection and maintenance according to engineering principles and safety regulations.										●		●										●	●										●		●
B	Inspecting plant to improve and maintain performance.		●		●		●								●		●	●						●	●								●		●		●
C	Directing the maintenance of plant buildings and equipment, and coordinating the requirements for new designs, surveys and maintenance schedules. **Preventive maintenance:** • 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...). • Plans, develops, executes approved modifications to the installation(s).		●	●	●	●	●			●	●				●		●	●	●	●		●		●	●	●		●	●	●	●		●		●		●
D	Advising management on new production methods, techniques and equipment.																						●	●										●		●
E	Liaising with materials buying, storing and controlling departments to ensure a steady flow of supplies.																						●	●										●		●

● No changes ● Reduced due to Circular Economy ● New or increased due to Circular Economy ● Reduced due to digitalization ● New or increased due to digitalization

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Maintenance & repair engineer - ISCO 2141s

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Maintenance and repair engineers focus on the optimization of equipment, procedures, machineries and infrastructure in a highly integrated digital ecosystem of the digital and ecoefficient manufacturing plant. They ensure their maximum availability at minimum costs and environmental impact.

- 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, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. waste generation or energy use reduction, recycling programs, green energy use, etc.).

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 tasks forecast**
●	●		●	●	●	●		●	●	●	A	Establishing standards and policies for installation, modification, quality control, testing, inspection and maintenance according to engineering principles, sustainability-oriented strategies and safety regulations in a highly digitised and ecoefficient manufacturing plant ecosystem.
●	●		●	●	●	●		●	●	●	B	Monitoring, inspection and digital registration of the plant to improve and maintain its technical and environmental performance (e.g. energy use, waste generation, air & water emissions, etc.).
●	●		●	●	●	●		●	●	●	C	Directing the digital handling of the maintenance of plant buildings and equipment, and coordinating the requirements for new designs, surveys and maintenance schedules, aligned with the sustainability strategies of the organisation. **Preventive maintenance:** • 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). • Analyses how to reduce the environmental impact of the plant and proposes modifications.
●	●		●	●	●	●		●		●	D	Advising management on new smarter and ecoefficient production methods, and best-available and digital techniques and equipment; considering the reduction of the environmental impact of the plant (e.g. reduction of raw materials, energy, waste, etc.).
●	●		●	●	●	●		●		●	E	Liaising with materials purchasing, storing and controlling departments to ensure a steady flow of sustainable supplies within and around the entire digital ecosystem and following green purchasing criteria.

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Maintenance & repair engineer - ISCO 2141s

2020 Current situation	2025-30 Situation forecast
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.	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. Maintenance of power plant stations (own green energy production), wastewater and waste treatment systems and recycling programs.
Mechanical hazard	
• Mechanical hazards from moving machines and tools.	• Mechanical hazards from moving machines and tools and from moving cobots and robots. Risks from mechanical hazards may decrease, depending on takeover of specific task by cobots/robots. Better design of products (ecodesign) could reduce hazards associated to maintenance operations.
Effects: severe bruises, amputations, cuts and sharp injuries, crushing.	**Effects**: severe bruises, amputations, cuts and sharp injuries, crushing.
• Slips and trips, obstacles, table edges, moving vehicles, machines.	• Slips and trips, obstacles, table edges, moving vehicles, machines.
Effects: squeezing, cutting, twisting, spraining, bumps and bruises.	**Effects**: squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: from poor ergonomic conditions, awkward position, confined spaces, heavy physical workload.	• 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 take over 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. Ecodesign may help to reduce exposure to awkward positions of maintenance workers if safe maintenance of the machinery is taken into consideration from the beginning.
Effect: musculoskeletal diseases.	**Effects**: musculoskeletal diseases.
Electrical hazards	
• Electrical hazards: contacts with live parts or connections or exposure to arc flash.	• Electrical hazards: contacts with live parts or connections or exposure to arc flash. Electrical hazards from woodworking machines (maybe broken) during maintenance and repair as well as from autonomous or highly autonomous equipment.
Effect: fatal accident.	**Effect**: fatal accident.
Hazards due to physical effects/physical agents	
• Noise	• Noise: exposure to noise and vibration may decrease, depending on takeover of specific tasks by cobots/robots. Noise maybe reduced due to ecodesign of machinery operating quieter and more environmental-friendly.
Effects: hearing loss, headache, nervousness, poor concentration.	**Effects**: hearing loss, headache, nervousness, poor concentration.
• Vibrations	• Vibrations: exposure to vibration risks may decrease, depending on takeover of specific task by cobots/robots. Vibration maybe reduced due to ecodesign of machinery operating with less vibration energy and more environmental-friendly.
Effects: hand-arm-vibration syndrome (e.g. white finger disease).	**Effects**: hand-arm-vibration syndrome (e.g. white finger disease).
Explosion and fire hazards	
• Explosion and fire hazards from materials, including wood dust, solvents and chemicals.	Explosion and fire hazards from materials, including wood dust, solvents and chemicals. Risks from explosion and fire may decrease, depending on takeover of specific task by cobots/robots. Solvents and cleaning products used for maintenance tasks may be based on less hazardous substances (e.g. solvents) and prevent fire hazards.
Effects: burns, fatal accidents.	**Effects**: burns, fatal accidents.

2020 Current situation	2025-30 Situation forecast
Work environmental hazards	
Work environmental hazards: excessive heat and cold, poor lighting.	Work environmental hazards: poor lighting, climate and temperature.
Effects: cardiovascular diseases, negative effects on muscles, tendons and joints, cold, eye strain, poor concentration.	**Effects**: cardiovascular diseases, negative effects on muscles, tendons and joints, cold, eye strain, headache, poor concentration.
Hazards through dangerous substances	
• Chemical hazards/ dangerous substances: asbestos, glass fibre, vapours, fumes, dust, solvents. Injury of the eyes caused by splashing lubricants, allergies due to contact with solvents, oils, hydraulic fluids and lubricants, exposure to dust. Contact with substances that are generated as by-products during maintenance activities and by the equipment used, such as welding fumes, diesel exhaust (e.g. from generators), and sanding dust.	• Chemical hazards/ dangerous substances: asbestos, glass fibre, vapours, fumes, dust, solvents, new materials. Injury of the eyes caused by splashing lubricants, allergies due to contact with solvents, oils, hydraulic fluids and lubricants, exposure to dust. Contact with substances that are generated as by-products during maintenance activities and by the equipment used, such as welding fumes, diesel exhaust (e.g. from generators), and sanding dust. The risk of being exposed to chemicals may decrease, depending on takeover of specific tasks by cobots/robots. Risks may decrease with use of cobots/robots. Maybe reduced, if the use of hazardous chemicals in products used for maintenance will be reduced/substituted due to circular economy.
Effects: contamination/intoxication, skin diseases, respiratory diseases, cancer.	**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.
	Recycling programs: Recycled material may contain dangerous substances, to the latest findings carcinogen or repro-toxic. (nowadays restricted by law (REACH)).
	Effects: contamination/intoxication, skin diseases, respiratory diseases, cancer.
• Biological hazards: bacteria, mould and fungi (e.g. lubricants may contain biological hazards).	• Biological hazards: bacteria, mould and fungi (e.g. lubricants may contain biological hazards). Risk from non-targeted activities with microorganism. Risks may decrease with use of cobots/robots. Maintenance of machinery and systems such as: waste treatment, waste water treatment systems and power plant stations. New Companies using their own waste as an energy source (Shifting to renewable energies – e.g. from biomass), operate their own waste water treatment system.
Effects: contamination/intoxication, skin diseases, respiratory diseases, infections.	**Effects**: contamination/intoxication, allergies, skin diseases, respiratory diseases, infections.
Psychosocial hazards	
• Organisation of work: time pressure, shift work, stress, often related to poor work organisation and lack of training.	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. Lack of experience: New software and digital devices require training, some workers may not have enough competences and may feel overloaded, not experienced enough. Increased demand on competences and up-to-date knowledge on the current development in circular economy and recycling industry. Working with materials which have previously been manufactured: new skills need to be acquired throughout the production cycle. Repair, remanufacture and selective disassembly require new methods and procedures.
• Social relationship: difficult discussion with the management, difficult partners, lack of information.	• Social relationship: difficult discussion with the management, difficult partners, lack of information, lack of social contacts.
• Working method: teamwork, working outside of "core working hours".	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. Maintenance of machines and plants emerged from circular economic and sustainable oriented strategies/products/marketing projects.
Effects: stress, burnout.	**Effects**: stress, burnout.

Skills and competences needs

Forecast of training new needs due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Maintenance & repair engineer - ISCO 2141s

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Shift to renewable energies	Shift to renewable materials	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	Recycle materials	Virtualise indirect aspects of the product	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	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	YES, changed	●			●		●				●						
Create solutions to problems	YES, changed	●	●	●	●	●	●	●	●	●	●	●		●			●
Inspect industrial equipment	YES, changed	●			●		●				●						
Inspect machinery	YES, changed	●			●		●				●						
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	YES, changed													●	●		●
Mechanics	YES																
Quality assurance procedures	YES, changed	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Generic green skills, knowledge and competences (*)																	
Environmental awareness and willingness to learn	NEW	●	●	●	●	●	●	●	●	●	●	●					
Systems and risk analysis skills	NEW	●	●				●	●		●	●	●					
Innovation skills	NEW	●	●	●	●	●	●	●	●	●	●	●					
Coordination, management and business skills	NA																
Communication and negotiation skills	NEW	●	●	●	●	●		●		●	●	●					
Marketing skills	NA																
Strategic and leadership skills	NA																
Consulting skills	NA																
Networking, information technology and language skills	NEW	●	●	●	●					●	●	●					
Adaptability and transferability skills	NEW	●	●	●	●					●	●	●					
Entrepreneurial skills	NA																
Waste, energy and water quantification and monitoring	NEW	●				●	●	●	●	●	●	●					
Material use and impact quantification and monitoring	NEW		●			●	●	●	●	●	●						
Material use and impact minimisation	NEW		●					●	●	●	●						

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

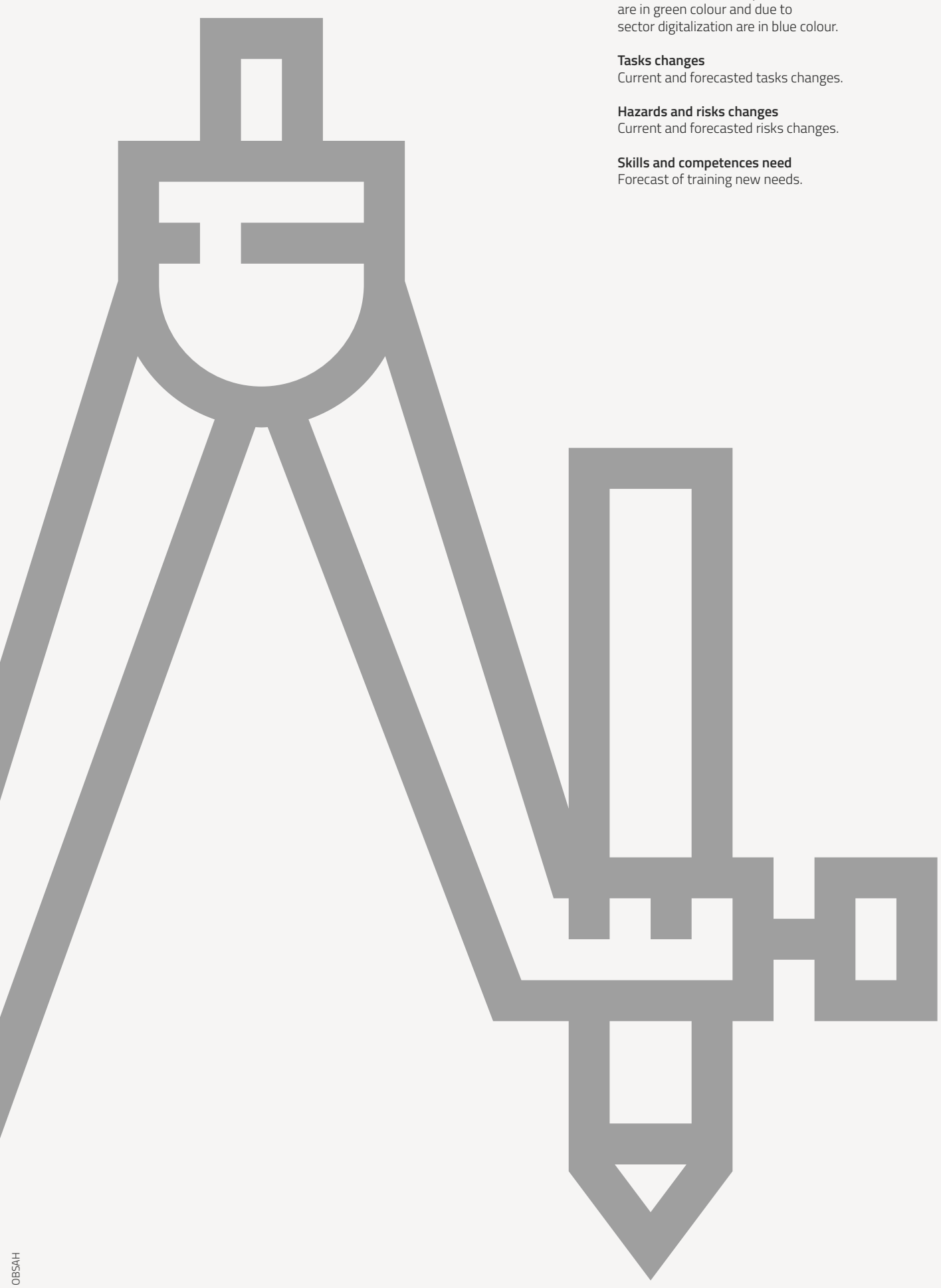
Furniture designer
ISCO 2163s

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.



Furniture designer
ISCO 2163s

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

JÍT NA OBSAH

Furniture designer
ISCO 2163s

2020
Occupational profile

Current profile description
Furniture designers work on items of furniture and related products. 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.
- Works 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 and technical services).
- Assists in the implementation of quality assurance activities.

Current profiles tasks		ReSOLVE levers*																							
		Regenerate	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste	
A	Determining the objectives and constraints of the design brief by consulting with clients and stakeholders.			●				●	●	●	●	●		●	●		●			●	●	●	●		
B	Formulating design concepts for industrial, commercial and consumer products.			●				●	●	●	●	●		●	●		●			●	●	●	●		
C	Harmonizing aesthetic considerations with technical, functional, ecological and production requirements.			●				●	●	●	●	●		●	●		●			●	●	●	●		
D	Preparing sketches, diagrams, illustrations, plans, samples and models to communicate design concepts.			●				●	●	●	●	●		●	●		●			●	●	●	●		
E	Negotiating design solutions with clients, management, and sales and manufacturing staff.			●				●	●	●	●	●		●	●					●	●	●	●		
F	Selecting, specifying and recommending functional and aesthetic materials, production methods and finishes for manufacture.			●				●	●	●	●	●		●	●		●	●		●	●	●	●		
G	Detailing and documenting the selected design for production.			●				●	●	●	●	●		●	●	●	●			●	●	●	●		
H	Preparing and commissioning prototypes and samples.			●						●	●	●		●	●	●	●			●	●	●	●		
I	Supervising the preparation of patterns, programmes and tooling, and of the manufacturing process.			●				●	●	●	●	●		●	●	●	●	●		●	●	●	●		

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Furniture designer - ISCO 2163s

2025/30
Occupational profile

Description forecast of the occupational profile in 2030

Furniture designers work on items of future furniture and related products exploiting the newest eco-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 and environmental requirements and aesthetic appeal.

- Uses digitization tools to work in a customer-oriented manner
- Considers cost, environmental impact 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 and sustainability activities.
- Applies a life-cycle thinking approach and the ecodesign methodology.
- Uses tools to assess the environmental profile of the designed product (e.g. impact of the materials used in the product, etc.).

Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	**Profile tasks forecast**
	●	●		●	●	●	A Determining the objectives and constraints of the design (including environmental performance) using real life computational simulation models and integrating environmental protection criteria over product's lifecycle, by consulting with clients and stakeholders and aligned with the circular economy-oriented strategies of the organisation.
	●	●		●	●	●	B Formulating design concepts, based on a life-cycle thinking and circularity approach and using rapid experimentation and digital models, for industrial, commercial and consumer products and services.
	●	●		●	●	●	C Use virtual models to help harmonizing aesthetic considerations with technical, functional, ecological and production requirements, considering the complete life-cylce of the product, from raw materials selection to end-of-life scenario.
	●	●		●	●	●	D Make digital (virtual) models and physical samples and models through rapid prototyping to communicate design concepts and the environmental performance of the product, considereing its complete life-cycle.
	●	●		●	●	●	E Negotiating digital design solutions with clients, management, and sales and manufacturing staff based on the sustainability strategies of the customers and the organisation.
	●	●		●	●	●	F Selecting, specifying and recommending functional, environmental-friendly and aesthetic materials, ecoefficient production methods and finishes for manufacturing using the highly digitised set of tools and considering the complete life-cycle of the products (e.g. end-of-life scenario).
	●	●		●	●		G Detailing and documenting the selected circular economy-oriented and digital design for production.
	●	●		●	●		H Preparing and commissioning physical and digital prototypes, models and samples to assess the technical & environmental performance of the product, prior its launch.
	●	●		●	●		I Supervising the preparation of patterns, programmes and tooling, and of the digital manufacturing process, to reduce its environmental impact, for example energy consumption or waste generation.

Furniture designer
ISCO 2163s

2020
Occupational profile

Current profile description
Furniture designers work on items of furniture and related products. 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.
- Works 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 and technical services).
- Assists in the implementation of quality assurance activities.

New categorization of hazards

Current profiles tasks		**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	Laserlight	**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)	Recycled material	**Biological Hazards**	Non-targeted activities with microorganism	**Psychosocial hazards**	Excessive workloads	Low job satisfaction	Work tasks not clearly defined
A	Determining the objectives and constraints of the design brief by consulting with clients and stakeholders.																																					
B	Formulating design concepts for industrial, commercial and consumer products.												●									●	●														●		●	
C	Harmonizing aesthetic considerations with technical, functional, ecological and production requirements.												●									●	●														●		●	
D	Preparing sketches, diagrams, illustrations, plans, samples and models to communicate design concepts.												●									●	●														●		●	
E	Negotiating design solutions with clients, management, and sales and manufacturing staff.						●															●	●														●		●	
F	Selecting, specifying and recommending functional and aesthetic materials, production methods and finishes for manufacture.						●															●	●														●		●	
G	Detailing and documenting the selected design for production.												●									●	●														●		●	
H	Preparing and commissioning prototypes and samples.		●	●			●								●							●	●	●					●	●						●		●	
I	Supervising the preparation of patterns, programmes and tooling, and of the manufacturing process.																					●	●														●		●	

● No changes ● Reduced due to Circular Economy ● New or increased due to Circular Economy ● Reduced due to digitalization ● New or increased due to digitalization

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Furniture designer - ISCO 2163s

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Furniture designers work on items of future furniture and related products exploiting the newest eco-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 and environmental requirements and aesthetic appeal.

- Uses digitization tools to work in a customer-oriented manner
- Considers cost, environmental impact 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 and sustainability activities.
- Applies a life-cycle thinking approach and the ecodesign methodology.
- Uses tools to assess the environmental profile of the designed product (e.g. impact of the materials used in the product, etc.).

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 tasks forecast**
●	●		●	●	●	●		●		●	A	Determining the objectives and constraints of the design (including environmental performance) using real life computational simulation models and integrating environmental protection criteria over product's lifecycle, by consulting with clients and stakeholders and aligned with the circular economy-oriented strategies of the organisation.
●	●		●	●	●	●		●	●	●	B	Formulating design concepts, based on a life-cycle thinking and circularity approach and using rapid experimentation and digital models, for industrial, commercial and consumer products and services.
●	●		●	●	●	●		●	●	●	C	Use virtual models to help harmonizing aesthetic considerations with technical, functional, ecological and production requirements, considering the complete life-cylce of the product, from raw materials selection to end-of-life scenario.
●	●		●	●	●	●		●		●	D	Make digital (virtual) models and physical samples and models through rapid prototyping to communicate design concepts and the environmental performance of the product, considereing its complete life-cycle.
●	●		●	●	●	●		●		●	E	Negotiating digital design solutions with clients, management, and sales and manufacturing staff based on the sustainability strategies of the customers and the organisation.
●	●		●	●	●	●		●		●	F	Selecting, specifying and recommending functional, environmental-friendly and aesthetic materials, ecoefficient production methods and finishes for manufacturing using the highly digitised set of tools and considering the complete life-cycle of the products (e.g. end-of-life scenario).
●	●		●	●	●	●		●	●	●	G	Detailing and documenting the selected circular economy-oriented and digital design for production.
●	●		●	●	●	●		●		●	H	Preparing and commissioning physical and digital prototypes, models and samples to assess the technical & environmental performance of the product, prior its launch.
●	●		●	●	●	●		●		●	I	Supervising the preparation of patterns, programmes and tooling, and of the digital manufacturing process, to reduce its environmental impact, for example energy consumption or waste generation.

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Furniture designer – ISCO 2163s

2020 Current situation	2025-30 Situation forecast
Work area: office workplace, computer workplace, meeting room, sales rooms, discussion with difficult clients, managers and manufacturing staff, workshop for preparing prototypes and patterns.	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 digitalized tools. Taking into consideration design of sustainable products made from e.g. recycled materials with energy saving processes.
Mechanical hazards	
• Mechanical hazards: (when working in workshops to prepare prototypes): from moving machines and tools.	• Mechanical hazards: (when working in workshops to prepare prototypes): from moving machines and tools.
Effects: bruises, cuts and sharp injuries, crushing.	**Effects**: bruises, cuts and sharp injuries, crushing.
• Slips and trips, obstacles, table edges, moving vehicles, machines.	• Slips and trips, obstacles, table edges, moving vehicles, machines.
Effects: squeezing, cutting, twisting, spraining, bumps and bruises.	**Effects**: squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: from poor ergonomic conditions and inactivity, prolonged sitting and from poor ergonomic practices with mobile devices.	• Ergonomic hazards: from poor ergonomic conditions and inactivity, prolonged sitting and from poor ergonomic practices with mobile devices. Digitalization 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 digitalization.
Effects: chronic neck and back pain, obesity and cardiovascular diseases.	**Effects**: chronic neck and back pain, obesity and cardiovascular diseases.
Electrical hazards	
• Electrical hazards: contacts with live parts or connections or exposure to arc flash.	• Electrical hazards: contacts with live parts or connections or exposure to arc flash.
Effect: fatal accident.	**Effect**: fatal accident.
Work environmental hazards	
• Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature.	• Work environmental hazards: software not appropriate, poor lighting and inappropriate indoor air quality and temperature.
Effects: eyestrain, headache, colds, cardiovascular problems.	**Effects**: eyestrain, headache, colds, cardiovascular problems.
Hazards through dangerous substances	
	• Experiments and work with new materials and with recycled materials.
	Effects: not yet well known, included are among others skin diseases, respiratory diseases, cancer.
Psychosocial hazards	
• 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.	• 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. Increased demand on competences and up-to-date knowledge on the current development in circular economy and recycling industry.
• Social relationship: difficult clients, difficult colleagues.	• Social relationship: difficult clients, difficult colleagues.
• Working method: working alone frequently, cooperation with other departments.	• Working method: working alone frequently, cooperation with other departments; digitalization 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. Increased demand on knowledge regarding the design of sustainable products respecting circular economy. Workers are also 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. Deciding on circular economic and sustainable oriented strategies/products: increased demand on skills and knowledge/keeping up-to-date regarding the current development in circular economy and sustainable oriented strategies/products (staying up-to-date; further training for new technologies and processes).
	• 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 requires an increased flexibility.
Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.	**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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Furniture designer – ISCO 2163s

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Shift to renewable materials	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	Increase performance/efficiency of products	Customisation/made to order	Remanufacture products and/or components	Implement Take Back programs	Recycle materials	Promote the cascade use of wood	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	Replace old materials with advanced renewable ones	Apply new technologies	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, changed	●	●	●	●	●	●	●	●	●	●	●	●	●	●					
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, changed	●						●	●	●				●	●					
Ergonomics	YES																			
Industrial design	YES, changed	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●
Manufacturing processes	YES, changed	●						●	●	●				●	●			●	●	
Mathematics	NO																			
Generic green skills, knowledge and competences (*)																				
Environmental awareness and willingness to learn	NEW	●	●	●	●	●	●		●	●	●	●								
Systems and risk analysis skills	NA																			
Innovation skills	NEW	●	●	●	●	●		●		●		●	●	●	●					
Coordination, management and business skills	NEW	●				●	●		●	●	●			●	●					
Communication and negotiation skills	NEW	●				●	●		●	●	●	●	●	●	●					
Marketing skills	NEW	●					●		●		●	●	●		●					
Strategic and leadership skills	NA																			
Consulting skills	NEW	●				●	●		●	●	●	●	●	●	●					
Networking, information technology and language skills	NEW	●	●	●	●	●		●		●		●	●	●	●					
Adaptability and transferability skills	NEW	●	●	●	●	●	●	●	●		●			●	●					
Entrepreneurial skills	NEW	●	●	●	●	●		●		●		●	●	●	●					
Waste, energy and water quantification and monitoring	NEW	●				●		●	●	●	●		●	●	●					
Material use and impact quantification and monitoring	NEW	●				●		●	●	●	●		●	●	●					
Material use and impact minimisation	NEW	●	●	●	●	●		●	●	●	●		●	●	●					

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

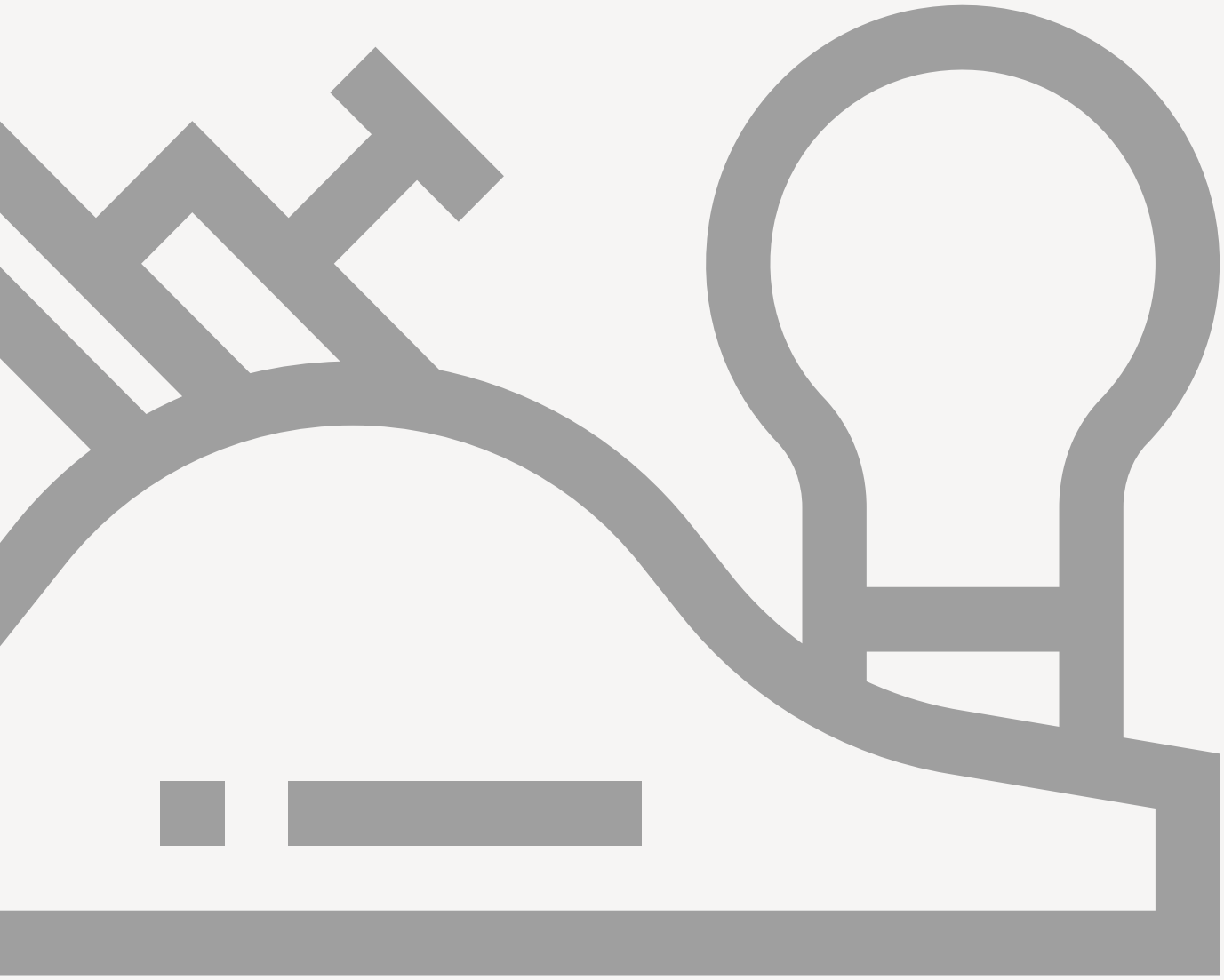
Cabinet-maker and related workers
ISCO 7522

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.



Cabinet-maker and related workers
ISCO 7522

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

JÍT NA OBSAH

Cabinet-maker and related workers ISCO 7522

2020
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 profiles tasks		ReSOLVE levers*																								
		Regenerate	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste		
A	Operating woodworking machines such as power saws, jointers, mortisers and shapers, and using hand tools to cut, shape and form parts and components. - 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.			●						●	●	●		●	●	●	●	●				●				
G				●				●						●		●	●				●	●	●	●		
H				●				●	●	●	●	●		●	●	●	●	●		●	●	●	●			

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Cabinet-maker and related workers - ISCO 7522

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

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, ecoefficient 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.
- Uses digitization tools to work in a customer-oriented manner.
- Considers cost, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. waste generation or energy use reduction, etc.).
- Applies a life-cycle thinking and favour the future disassembly of the product for maintenance, repair, reuse or recycling.

	Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	**Profile tasks forecast**
A					●	●		Operating connected, digitized, ecoefficient 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. • Selecting, controlling, mounting and replacement of cutting tools on the woodworking machines. • Operating connected, digitized, ecoefficient and highly automated woodworking machines. • Optimising the use of resources and energy and reducing to maximum the generated waste (e.g. wood scrap).
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 technical & environmental specifications, including product durability, reparability, etc.
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, considering the future disassembly needs and potential reparability of the product (e.g. reducing glued components, etc.).
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, in line with the circular economy-oriented strategies of the organisation (e.g. increase product durability).
E		●	●		●	●	●	Create environmental-friendly 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 and ecoefficient machines such as laser-cutting cobots and other human-robot collaboration, using sustainable materials and taking into account future disassembling and whole product life cycle.
F					●	●		Finishing surfaces of wooden articles or furniture using non-hazardous substances (e.g. low-VOCs chemicals) through highly automated, even autonomous machines, cobots and robots, that can be remotely operated (with the help of Augmented Reality) using big data.
G					●			Selective and/or destructive disassembling of out of use or defective wood-based furniture products for separation of materials and elements for further recovery or recycling.
H					●	●	●	Operating tools and highly digitized, connected and automated woodworking machines for the maintenance, reparation and/or re-manufacturing of wood-based furniture products, including cleaning, polishing and/or additional finishing treatments.

Cabinet-maker and related workers ISCO 7522

2020
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.

New categorization of hazards

Current profiles tasks		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	Laserlight	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)	Recycled material	Biological Hazards	Non-targeted activities with microorganism	Psychosocial hazards	Excessive workloads	Low job satisfaction	Work tasks not clearly defined
A	Operating woodworking machines such as power saws, jointers, mortisers and shapers, and using hand tools to cut, shape and form parts and components. - 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.			●	●		●			● ●	● ●						● ●	● ●	●		● ●		●	●	●		●	●	●	●	●				●		●
G			●	●		●	●			●	●						●	●					●	●	●		●	●	●	●	●		●				●
H			●	●		●	●			●	●						●	●					●	●	●		●	●	●	●	●		●				●

● No changes ● Reduced due to Circular Economy ● New or increased due to Circular Economy ● Reduced due to digitalization ● New or increased due to digitalization

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Cabinet-maker and related workers - ISCO 7522

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

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, ecoefficient 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.
- Uses digitization tools to work in a customer-oriented manner.
- Considers cost, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. waste generation or energy use reduction, etc.).
- Applies a life-cycle thinking and favour the future disassembly of the product for maintenance, repair, reuse or recycling.

	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 tasks forecast**
A	●	●		●	●	●	●	●	●	●	●	Operating connected, digitized, ecoefficient 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. • Selecting, controlling, mounting and replacement of cutting tools on the woodworking machines. • Operating connected, digitized, ecoefficient and highly automated woodworking machines. • Optimising the use of resources and energy and reducing to maximum the generated waste (e.g. wood scrap).
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 technical & environmental specifications, including product durability, reparability, etc.
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, considering the future disassembly needs and potential reparability of the product (e.g. reducing glued components, etc.).
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, in line with the circular economy-oriented strategies of the organisation (e.g. increase product durability).
E	●	●		●	●	●	●	●	●	●	●	Create environmental-friendly 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 and ecoefficient machines such as laser-cutting cobots and other human-robot collaboration, using sustainable materials and taking into account future disassembling and whole product life cycle.
F	●	●		●	●	●	●	●	●	●	●	Finishing surfaces of wooden articles or furniture using non-hazardous substances (e.g. low-VOCs chemicals) through highly automated, even autonomous machines, cobots and robots, that can be remotely operated (with the help of Augmented Reality) using big data.
G	●	●				●	●	●	●		●	Selective and/or destructive disassembling of out of use or defective wood-based furniture products for separation of materials and elements for further recovery or recycling.
H	●	●				●	●	●	●		●	Operating tools and highly digitized, connected and automated woodworking machines for the maintenance, reparation and/or re-manufacturing of wood-based furniture products, including cleaning, polishing and/or additional finishing treatments.

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Cabinet-maker and related workers - ISCO 7522

2020 Current situation	2025-30 Situation forecast
Work area: workshops with wood processing machines, hand and power tools such as (sanders, circular/crosscut/ripsaws), wood storage, finishing of wood products.	Work area: workshops with wood processing machines, hand and power tools such as (sanders, circular/crosscut/ripsaws), wood storage, storage of new and recycled materials, finishing of wood products, use of digitalized tools, disassembly, dismantling, repair, reuse, maintenance and remanufacturing of furniture.
Mechanical hazards	
• 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).	• 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. Remanufacturing and selective disassembling could require new type of tools not available. Better design of products (ecodesign) could reduce hazards associated to assembly/ disassembly operations, using optimised joining systems, etc.
Effects: severe bruises, amputations, cuts and sharp injuries, crushing.	**Effects**: severe bruises, amputations, cuts and sharp injuries, crushing.
• Slips and trips, obstacles, table edges, moving vehicles, machines.	• Slips and trips, obstacles, table edges, moving vehicles, machines.
Effects: squeezing, cutting, twisting, spraining, bumps and bruises.	**Effects**: squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: poor ergonomic conditions, heavy physical workload.	• Ergonomic hazards: poor ergonomic conditions, heavy physical workload. Risks from ergonomic hazards may decrease, depending on take over 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. Maintenance, remanufacturing and repair services as well as dismantling of manufactured goods may be related to Musculoskeletal Disorders (MSDs) (e.g. awkward positions, heavy lifting and carrying). This risk could be reduced with ecodesign strategies to facilitate assembly/disassembly (e.g. type of fasteners, etc.) if occupational safety and health is taken into account when designing the product.
Effect: musculoskeletal diseases.	**Effect**: musculoskeletal diseases.
Electrical hazards	
• Electrical hazards: contacts with live parts or connections or exposure to arc flash. Electrical hazards from woodworking machines.	• 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.	**Effect**: fatal accident.
Hazards due to physical effects/physical agents	
• Noise	• Noise: exposure to noise may decrease, depending on takeover of specific tasks by cobots/robots. Noise maybe reduced due to ecodesign of machinery operating quieter and more environmental-friendly. However, dismantling activities may expose workers still to noise.
Effects: hearing loss, headache, nervousness, poor concentration.	**Effects**: hearing loss, headache, nervousness, poor concentration.
• Vibrations	• Vibrations: exposure to vibration may decrease, depending on takeover of specific tasks by cobots/robots. Possible more use of vibrating tools during dismantling, product remanufacturing or repair (polisher, etc.). Vibration maybe reduced due to ecodesign of machinery operating with less vibration energy and more environmental-friendly.
Effects: hand-arm-vibration syndrome (e.g. white finger disease).	**Effects**: hand-arm-vibration syndrome (e.g. white finger disease).
• Laserlight	• Laserlight: cabinet makers may be exposed to laserlight.
Effects: eye damage, negative effects similar to sunburn.	**Effects**: eye damage, negative effects similar to sunburn.
Fire and explosion hazards	
• Fire and explosion hazards from materials, including wood dust, solvents and chemicals.	• Fire and explosion 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. Dust maybe emitted during dismantling, remanufacturing or repair activities– inappropriate dust extraction system increases risk of dust explosion. Risk from explosion and fire may decrease, depending on the substitution of flammable solvents in glues.
Effects: burns, fatal accidents.	**Effects**: burns, fatal accidents.

2020 Current situation	2025-30 Situation forecast
Work environmental hazards	
• Work environmental hazards: poor lighting, climate and temperature. **Effects**: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain, headache.	• Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation. **Effects**: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain, headache.
Hazards through dangerous substances	
• Chemical hazards/ dangerous substances: asbestos, glass fibre, vapours, fumes, dust, solvents, new materials (nanomaterials). **Effects**: contamination/intoxication, skin diseases, respiratory diseases, cancer.	• Chemical hazards/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. Chemical hazards may be reduced, if OSH will be included in the design of the products/materials (use of less dangerous substances) and if dangerous substances will be substituted by less dangerous substances (solvents, glues, formaldehyde). Disassembling, dismantling: Exposure to fibres or dust when disassembling, dismantling products. **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. • Recycled material: Risk of exposure to dangerous substances may be increased through lack of information on chemicals contained in recycled products and on ways how to deal with them appropriately. Recycled material may contain dangerous substances, to the latest findings carcinogen or repro-toxic. (nowadays restricted by law (REACH)). **Effects**: contamination/intoxication, skin diseases, respiratory diseases, cancer.
Biological hazards	
• Biological hazards: bacteria, mould and fungi. **Effects**: contamination/intoxication, skin diseases, respiratory diseases, infections.	• Non-targeted activities with microorganism: selective and/or destructive disassembling for separation of materials and elements for further recovery or recycling may expose workers to microorganism such as mould (Recycled, old and used material may contain mould). **Effects**: contamination/intoxication, skin diseases, respiratory diseases, infections.
Psychosocial hazards	
• Organisation of work: time pressure, shift work, stress, often related to poor work organisation lack of training.	• 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. Lack of experience: New software and digital devices require training, some workers may not have enough competences and may feel overloaded, not experienced enough. Increased demand on competences and up-to-date knowledge on the current development in circular economy and recycling industry. Working with materials which have previously been manufactured: new skills need to be acquired throughout the production cycle. Repair, remanufacture and selective disassembly require new methods and procedures.
• Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues.	• Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues, lack of social contacts.
• Working method: operating woodworking machines, working with colleagues. **Effects**: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.	• 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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Cabinet-maker and related workers - ISCO 7522

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Shift to renewable materials	Increase performance/efficiency of products	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Remanufacture products and/or components	Recycle materials	Promote the cascade use of wood	Apply new technologies	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 cobots, 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		●	●		●			●		●		●	
Disassemble wood-based furniture products	NEW	●	●	●	●	●	●	●	●		●		●	
Examine disassembled pieces for further steps (reuse, recylce, upcycle)	NEW	●	●	●	●	●	●	●	●		●		●	
Repair wood-based furniture pieces, where needed	NEW	●	●	●	●	●	●	●	●		●		●	
Essential knowledge														
Construction products	YES, changed	●	●	●	●	●	●	●	●	●		●		●
Furniture trends	YES, changed	●	●	●		●	●	●	●	●		●		
Sanding techniques	YES, changed					●	●		●		●		●	
Technical drawings	YES, changed	●	●	●		●	●		●	●		●		●
Types of wood	YES, changed	●	●		●	●	●	●	●					
Wood products	YES, changed	●	●		●	●	●	●	●					
Woodturning	YES, changed		●	●		●			●		●		●	
Generic green skills, knowledge and competences (*)														
Environmental awareness and willingness to learn	NEW		●	●		●	●	●	●					
Systems and risk analysis skills	NA													
Innovation skills	NEW	●	●	●		●		●	●					
Coordination, management and business skills	NA													
Communication and negotiation skills	NEW	●						●						
Marketing skills	NA													
Strategic and leadership skills	NA													
Consulting skills	NEW	●	●	●	●			●						
Networking, information technology and language skills	NA													
Adaptability and transferability skills	NEW	●	●	●		●	●	●	●					
Entrepreneurial skills	NA													
Waste, energy and water quantification and monitoring	NEW	●	●	●	●	●	●	●	●					
Material use and impact quantification and monitoring	NEW	●	●	●	●	●	●	●	●					
Material use and impact minimisation	NEW	●	●		●	●	●	●	●					

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

Woodworking-machine tool setter and operator
ISCO 7523

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.

Woodworking-machine tool setter and operator
ISCO 7523

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

Woodworking-machine tool setter and operator

ISCO 7523

2020

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 profiles tasks		ReSOLVE levers*																							
		Regenerate	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste	
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.			●										●	●	●	●	●		●		●	●		
H				●				●	●	●	●	●		●	●	●	●	●		●	●	●	●		

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Woodworking-machine tool setter and operator - ISCO 7523

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Woodworking machine tool setters and operators set-up, operate and monitor ecoefficient, semi-automatic or fully automated, even autonomous woodworking machines, such as precision sawing, shaping, planing, boring, turning and woodcarving machines to fabricate, remanufacture 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.
- Uses digitization software tools to work in a customer-oriented manner.
- Considers cost, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. waste generation or energy use reduction, etc.).

	Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	**Profile tasks forecast**
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 technical & environmental specifications, including product durability.
B			●			●		Setting up, programming, operating and monitoring several types of connected and ecoefficient 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, trying to minimise the generated waste and the use of resources.
C			●		●	●		Operating special-purpose ecoefficient, automated and real-time optimized woodworking machines to fabricate wooden products such as coat hangers, mop handles, clothespins and other products, optimising the use of resources and the generation of waste.
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, optimising the use of resources, consumables and the generation of waste.
E			●		●	●		Installing and adjusting blades, cutter heads, boring-bits and sanding-belts using cobots and semi-autonomous robots, reducing the use of resources, consumables and the generation of waste.
F			●		●	●		Use cobots for the autonomous selection, control, mounting and replacing of cutting tools on the woodworking machines, reducing the use of resources, consumables and the generation of waste.
G			●		●	●		Setting and adjusting through digitized and remote controls various kinds of connected and ecoefficient woodworking machines for operation by others; studying and interpreting technical & environmental specifications using simulation models and mixed/augmented reality.
H					●	●		Operating tools and semi-automatic or fully automated, even autonomous woodworking machines for the maintenance, reparation and/or re-manufacturing of wood-based products, including cutting, polishing and/or additional finishing treatments.

Woodworking-machine tool setter and operator

ISCO 7523

2020

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.

New categorization of hazards

Current profiles tasks		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	Laserlight	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)	Recycled material	Biological Hazards	Non-targeted activities with microorganism	Psychosocial hazards	Excessive workloads	Low job satisfaction	Work tasks not clearly defined
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.												●										●	●										●		●
H			●	●		●	●								●		●	●					●	●			●	●		●				●		●

● No changes ● Reduced due to Circular Economy ● New or increased due to Circular Economy ● Reduced due to digitalization ● New or increased due to digitalization

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Woodworking-machine tool setter and operator - ISCO 7523

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Woodworking machine tool setters and operators set-up, operate and monitor ecoefficient, semi-automatic or fully automated, even autonomous woodworking machines, such as precision sawing, shaping, planing, boring, turning and woodcarving machines to fabricate, remanufacture 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.
- Uses digitization software tools to work in a customer-oriented manner.
- Considers cost, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. waste generation or energy use reduction, etc.).

	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 tasks forecast**
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 technical & environmental specifications, including product durability.
B	●	●		●	●	●	●		●		●	Setting up, programming, operating and monitoring several types of connected and ecoefficient 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, trying to minimise the generated waste and the use of resources.
C	●	●		●	●	●	●		●		●	Operating special-purpose ecoefficient, automated and real-time optimized woodworking machines to fabricate wooden products such as coat hangers, mop handles, clothespins and other products, optimising the use of resources and the generation of waste.
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, optimising the use of resources, consumables and the generation of waste.
E	●	●		●	●	●	●		●		●	Installing and adjusting blades, cutter heads, boring-bits and sanding-belts using cobots and semi-autonomous robots, reducing the use of resources, consumables and the generation of waste.
F	●	●		●	●	●	●		●		●	Use cobots for the autonomous selection, control, mounting and replacing of cutting tools on the woodworking machines, reducing the use of resources, consumables and the generation of waste.
G	●	●		●	●	●	●		●		●	Setting and adjusting through digitized and remote controls various kinds of connected and ecoefficient woodworking machines for operation by others; studying and interpreting technical & environmental specifications using simulation models and mixed/augmented reality.
H	●	●		●	●	●	●		●		●	Operating tools and semi-automatic or fully automated, even autonomous woodworking machines for the maintenance, reparation and/or re-manufacturing of wood-based products, including cutting, polishing and/or additional finishing treatments.

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Woodworking-machine tool setter and operator - ISCO 7523

2020 Current situation	2025-30 Situation forecast
Work area: workshops with wood processing machines, hand and power tools such as (sanders, circular/crosscut/ripsaws), wood storage, finishing of wood products.	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. Working with new and recycled material, remanufacture and repair of products. Reparation and remanufacture of wood-based products.
Mechanical hazards	
• 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).	• 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. 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. Better design of machinery and tools (ecodesign) could reduce hazards associated to working with woodworking machinery and hand power tools.
Effects: severe bruises, amputations, cuts and sharp injuries, crushing.	**Effects**: severe bruises, amputations, cuts and sharp injuries, crushing.
• Slips and trips, obstacles, table edges, moving vehicles, machines.	• Slips and trips, obstacles, table edges, moving vehicles, machines.
Effects: squeezing, cutting, twisting, spraining, bumps and bruises.	**Effects**: squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload.	• Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload. Risks from ergonomic hazards may decrease, depending on take over 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. The risk could be reduced with ecodesign strategies if occupational safety and health is taken into account when designing the product and machines.
Effect: musculoskeletal diseases.	**Effect**: musculoskeletal diseases.
Electrical hazards	
• Electrical hazards: contacts with live parts or connections or exposure to arc flash.	• 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.	**Effect**: fatal accident.
Hazards due to physical effects/physical agents	
• Noise	• Noise: exposure to noise may decrease, depending on takeover of specific tasks by cobots/robots. The risk could be reduced with ecodesign strategies if occupational safety and health is taken into account when designing the product and machines.
Effects: hearing loss, headache, nervousness, poor concentration.	**Effects**: hearing loss, headache, nervousness, poor concentration.
• Vibrations	• Vibrations: exposure to vibrations may decrease, depending on takeover of specific tasks by cobots/robots. The risk could be reduced with ecodesign strategies if occupational safety and health is taken into account when designing the product and machines.
Effect: hand-arm-vibration syndrome (e.g. white finger disease).	**Effect**: hand-arm-vibration syndrome (e.g. white finger disease).
• Laserlight	• Laserlight: woodworking machine tool setters and operators may be exposed to laserlight.
Effects: eye damage, negative effects similar to sunburn.	**Effects**: eye damage, negative effects similar to sunburn.
Fire and explosion hazards	
• Fire and explosion hazardsfrom materials, including wood dust, solvents and chemicals.	• Fire and explosion 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. Solvents and cleaning products used for maintenance tasks may be based on less hazardous substances (e.g. solvents) and prevent fire hazards.

2020 Current situation	2025-30 Situation forecast
Work environmental hazards	
• Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation.	• Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation.
Effects: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.	**Effects**: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.
Hazards through dangerous substances	
• Chemical hazards/dangerous substances: wood dust.	• Chemical hazards/dangerous substances: wood dust, dust of recycled material. The risk of being exposed to wood dust may decrease, depending on takeover of specific tasks by cobots/robots. Maybe reduced, if OSH will be included in the design of the products/ materials, less dangerous solvents and lubricants.
Effects: contamination/intoxication, respiratory diseases, wood dusts (carcinogens, allergens) may cause nasal or lung cancer.	**Effects**: contamination/intoxication, respiratory diseases, wood dusts (carcinogens, allergens) may cause nasal or lung 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.
	• Recycled material: Risk of exposure to dangerous substances may be increased through lack of information on chemicals contained in recycled products and on ways how to deal with them appropriately. Recycled material may contain dangerous substances, to the latest findings carcinogen or repro-toxic. (nowadays restricted by law (REACH)). **Effects**: contamination/intoxication, skin diseases, respiratory diseases, cancer.
Psychosocial hazards	
• Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility, repetitive, monotonous work.	• Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility and digital know how, repetitive, monotonous work. Lack of experience: New software and digital devices require training, some workers may not have enough competences and may feel overloaded, not experienced enough. Increased demand on competences and up-to-date knowledge on the current development in circular economy and recycling industry. Working with materials which have previously been manufactured: new skills need to be acquired throughout the production cycle.
• Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues.	• Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues, lack of social contacts.
• Working method: working with colleagues.	• 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.	**Effects**: stress, burnout.

Skills and competences needs

Forecast of training new needs due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Woodworking-machine tool setter and operator - ISCO 7523

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	Remanufacture products and/or components	Promote the cascade use of wood	Apply new technologies	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, changed	●		●		●	●						
Dispose of cutting waste material	YES, changed		●	●		●	●	●					
Maintain furniture machinery	YES												
Monitor automated machines	YES, changed	●	●	●	●	●	●	●	●			●	●
Operate furniture machinery	YES, changed		●	●		●		●		●	●	●	
Remove inadequate workpieces	YES, changed												●
Remove processed workpiece	YES												
Set up the controller of a machine	YES, changed									●			
Supply machine	YES												
Supply machine with appropriate tools	YES, changed									●	●	●	
Disassemble wood-based furniture products	NEW	●	●	●		●	●			●		●	
Examine disassembled pieces for further steps (reuse, recylce, upcycle)	NEW	●	●	●	●	●	●	●		●		●	●
Repair wood-based furniture pieces, where needed	NEW	●	●	●	●	●	●	●		●		●	●
Essential knowledge													
Machine tools	YES												
Quality standards	YES, changed	●	●	●	●	●	●	●					●
Types of wood	NO												
Generic green skills, knowledge and competences (*)													
Environmental awareness and willingness to learn	NEW	●	●	●	●	●	●	●					
Systems and risk analysis skills	NA												
Innovation skills	NA												
Coordination, management and business skills	NA												
Communication and negotiation skills	NA												
Marketing skills	NA												
Strategic and leadership skills	NA												
Consulting skills	NA												
Networking, information technology and language skills	NA												
Adaptability and transferability skills	NEW	●	●	●	●	●	●	●					
Entrepreneurial skills	NA												
Waste, energy and water quantification and monitoring	NEW	●	●	●	●			●					
Material use and impact quantification and monitoring	NEW	●	●		●	●	●	●					
Material use and impact minimisation	NEW	●	●		●	●	●	●					

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

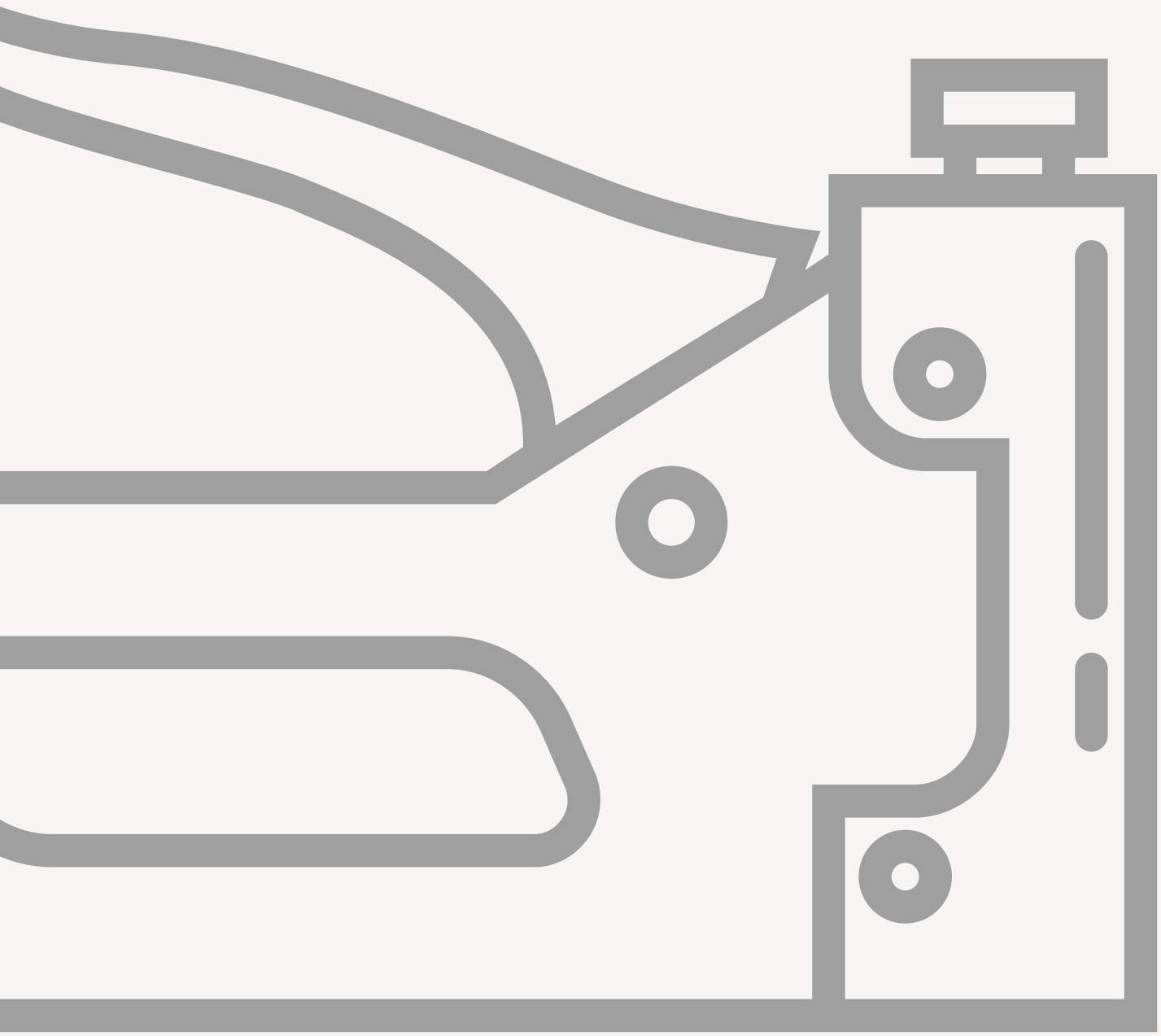
Upholsterer and related workers
ISCO 7534

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.



Upholsterer and related workers
ISCO 7534

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

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Upholsterer and related workers ISCO 7534

2020
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.

ReSOLVE levers*

Current profiles tasks		**Regenerate**	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste	
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. • 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 • 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. • Filling up cushions. • Filling up mattresses.			●					●	●	●	●		●	●	●	●	●			●	●	●		
M				●				●						●		●	●				●	●	●	●	
N				●				●	●	●	●	●		●	●	●	●	●		●	●	●	●		

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Upholsterer and related workers - ISCO 7534

2025/30
Occupational profile

Description forecast of the occupational profile in 2030

Upholsterers and related workers install, repair, remanufacture 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 ecoefficient semi-automatic 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.
- Uses digitization tools to work in a customer-oriented manner.
- Considers cost, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. materials used, waste generation or energy use reduction, etc.).
- Uses a life-cycle thinking approach when takes decissions on the materials to be used and favours the future disassembly of the product for maintenance, repair, reuse or recycling.

	Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	**Profile tasks forecast**
A		●	●		●	●	●	Using digital simulation models, discussing preferable eco-friendly upholstery fabric, colour and style with customers and providing cost estimates for upholstering furniture or other items, proposing sustainable materials and considering the future circularity of the product.
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 technical & environmental specifications, including product durability, reparability, etc.
C		●	●		●	●		Making upholstery patterns from digital models, sketches, customer descriptions, trying to favour sustainable raw materials and reducing as much as possible the generation of waste and the quantity of used materials.
D			●			●		Laying out, measuring and cutting eco-friendly upholstery materials using advanced digital process control following patterns, templates, sketches or design specifications, reducing as much as possible the scrap generated in the process.
E					●	●		Highly automated installing, arranging and securing springs, padding and eco-friendly covering material to furniture frames, thinking on the future needs for maintenance, repair, reuse or substitution of the product.
F						●		Sewing eco-friendly upholstery materials to seam cushions and joining sections of covering materials using semi-automated processes and connected cobots thinking on the future needs or disassembly for maintenance, repair or recycling of the product.
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 and ecoefficient machines for sewing-/locking; and considering the future need for maintenance, repair or recycling of the product.
H					●	●		Semi-autonomously tacking, gluing or sewing ornamental trims, buckles, braids, buttons and other accessories to covers or frames on upholstered items using cobots and considering aspects such as materials' compatibility for recycling, future disassembly needs, etc. (e.g. reducing glued components).
I		●	●		●	●	●	Highly automated laying out, cutting, fabricating and installing upholstery using ecoefficient and autonomous robots connected to the big data cloud. • Selecting sustainable materials and circular economy-oriented strategies (e.g. repairability). • Installing upholstery on the structure. • Finishing of the upholstery.
J			●		●	●	●	Renovating antique furniture with highly automated machines and cobots using a variety of tools including ripping chisels, magnetic hammers and long needles. • Ripping off the seats and sofas. • Demounting of the (structural) parts. • Checking what parts can be reused, repaired or need to be replaced. • Renovating of the upholstery. • Facilitating future maintenance, repair, reuse or recycling.
K		●	●		●	●	●	Using digital models and augmented reality to collaborate with interior designers to decorate rooms and coordinate furnishing fabrics, selecting sustainable materials and applying circular economy-oriented strategies.
L		●	●		●	●	●	Fully automated and ecoefficient manufacturing of eco-friendly quilts, cushions and mattresses, optimising the use of resources and reducing the generation of waste. • Filling up cushions. • Filling up mattresses.
M					●			Operating the adequate tools for selective and/or destructive disassembling of out of use or defective upholstery articles for separation of materials and elements for further recovery or recycling.
N			●		●	●	●	Operating highly automated machines and cobots for the maintenance, reparation and/or re-manufacturing of upholstery or upholstered parts of furniture, including cleaning, cutting, etc.

Upholsterer and related workers ISCO 7534

2020
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.

New categorization of hazards

Current profiles tasks		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	Laserlight	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)	Recycled material	Biological Hazards	Non-targeted activities with microorganism	Psychosocial hazards	Excessive workloads	Low job satisfaction	Work tasks not clearly defined
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. • 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 • 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. • Filling up cushions. • Filling up mattresses.										🔵 🟢		🟡				🔵 🟢	🔵 🟢					⚪	⚪			🔵			🟡				⚪	⚪	⚪
M			🔴	🔴		🔴	🔴				🔴				🔴		🔴	🔴			🔴		🔴	🔴	🔴		🔴				🔴		🔴		🔴		
N			🔴	🔴		🔴	🔴				🔴				🔴		🔴	🔴			🔴		🔴	🔴	🔴		🔴				🔴		🔴		🔴		

⚪ No changes 🟢 Reduced due to Circular Economy 🔴 New or increased due to Circular Economy 🔵 Reduced due to digitalization 🟡 New or increased due to digitalization

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Upholsterer and related workers - ISCO 7534

2025/30
Occupational profile

Description forecast of the occupational profile in 2030

Upholsterers and related workers install, repair, remanufacture 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 ecoefficient semi-automatic 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.
- Uses digitization tools to work in a customer-oriented manner.
- Considers cost, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. materials used, waste generation or energy use reduction, etc.).
- Uses a life-cycle thinking approach when takes decissions on the materials to be used and favours the future disassembly of the product for maintenance, repair, reuse or recycling.

	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 tasks forecast**
A	●	●		●	●	●	●		●		●	Using digital simulation models, discussing preferable eco-friendly upholstery fabric, colour and style with customers and providing cost estimates for upholstering furniture or other items, proposing sustainable materials and considering the future circularity of the product.
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 technical & environmental specifications, including product durability, reparability, etc.
C	●	●		●	●	●	●		●	●	●	Making upholstery patterns from digital models, sketches, customer descriptions, trying to favour sustainable raw materials and reducing as much as possible the generation of waste and the quantity of used materials.
D	●	●		●	●	●	●		●	●	●	Laying out, measuring and cutting eco-friendly upholstery materials using advanced digital process control following patterns, templates, sketches or design specifications, reducing as much as possible the scrap generated in the process.
E	●	●		●	●	●	●		●	●	●	Highly automated installing, arranging and securing springs, padding and eco-friendly covering material to furniture frames, thinking on the future needs for maintenance, repair, reuse or substitution of the product.
F	●	●		●	●	●	●		●	●	●	Sewing eco-friendly upholstery materials to seam cushions and joining sections of covering materials using semi-automated processes and connected cobots thinking on the future needs or disassembly for maintenance, repair or recycling of the product.
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 and ecoefficient machines for sewing-/locking; and considering the future need for maintenance, repair or recycling of the product.
H	●	●		●	●	●	●		●	●	●	Semi-autonomously tacking, gluing or sewing ornamental trims, buckles, braids, buttons and other accessories to covers or frames on upholstered items using cobots and considering aspects such as materials' compatibility for recycling, future disassembly needs, etc. (e.g. reducing glued components).
I	●	●		●	●	●	●		●	●	●	Highly automated laying out, cutting, fabricating and installing upholstery using ecoefficient and autonomous robots connected to the big data cloud. • Selecting sustainable materials and circular economy-oriented strategies (e.g. repairability). • Installing upholstery on the structure. • Finishing of the upholstery.
J	●	●		●	●	●	●		●	●	●	Renovating antique furniture with highly automated machines and cobots using a variety of tools including ripping chisels, magnetic hammers and long needles. • Ripping off the seats and sofas. • Demounting of the (structural) parts. • Checking what parts can be reused, repaired or need to be replaced. • Renovating of the upholstery. • Facilitating future maintenance, repair, reuse or recycling.
K	●	●		●	●	●	●		●		●	Using digital models and augmented reality to collaborate with interior designers to decorate rooms and coordinate furnishing fabrics, selecting sustainable materials and applying circular economy-oriented strategies.
L	●	●		●	●	●	●		●	●	●	Fully automated and ecoefficient manufacturing of eco-friendly quilts, cushions and mattresses, optimising the use of resources and reducing the generation of waste. • Filling up cushions. • Filling up mattresses.
M	●					●	●				●	Operating the adequate tools for selective and/or destructive disassembling of out of use or defective upholstery articles for separation of materials and elements for further recovery or recycling.
N	●				●	●	●			●	●	Operating highly automated machines and cobots for the maintenance, reparation and/or re-manufacturing of upholstery or upholstered parts of furniture, including cleaning, cutting, etc.

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Upholsterer and related workers – ISCO 7534

2020 Current situation	2025-30 Situation forecast
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.	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, use of eco-friendly materials, life-cycle thinking approach when taking decisions on the materials and design of the product (taking into account disassembly of the product for maintenance, repair, reuse or recycling).
Mechanical hazards	
• 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).	• 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. Risks from mechanical hazards may decrease, depending on takeover of specific task by cobots/robots. Remanufacturing and selective disassembling could require new types of tools. Risks of being injured by unprotected moving parts, uncontrolled moving parts (air tools/electric staplers, springs) and parts with hazardous shapes (cutting, pointed, rough). Better design of products (ecodesign) could reduce hazards associated to assembly/disassembly operations, using optimised joining systems, etc.
Effects: severe bruises, cuts and sharp injuries.	**Effects**: severe bruises, cuts and sharp injuries.
Slips and trips, obstacles, table edges, moving vehicles, machines.	Slips and trips, obstacles, table edges, moving vehicles, machines.
Effects: squeezing, cutting, twisting, spraining, bumps and bruises.	**Effects**: squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: from poor ergonomic conditions, awkward positions.	• Ergonomic hazards: from poor ergonomic conditions, awkward positions. Risks from ergonomic hazards may decrease, depending on take over 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. Remanufacturing and selective disassembling may be performed in unsuitable positions. This risk could be reduced with ecodesign strategies to facilitate assembly/disassembly (e.g. type of fasteners, etc.) if occupational safety and health is taken into account when designing the product.
Effect: musculoskeletal diseases.	**Effect**: musculoskeletal diseases.
Electrical hazards	
Electric hazards: contacts with live parts or connections or exposure to arc flash.	Electric hazards: contacts with live parts or connections or exposure to arc flash. Electrical hazards from upholstery machines and from autonomous or highly autonomous equipment.
Effect: fatal accident.	**Effect**: fatal accident.
Hazards due to physical effects/physical agents	
• Noise	• Noise: exposure to noise may decrease, depending on takeover of specific task by cobots/robots. Noise maybe reduced due to ecodesign of machinery operating quieter and more environmental-friendly. However, dismantling or remanufacturing upholstered furniture may pose workers at risk of noise.
Effects: hearing loss, headache, nervousness, poor concentration.	**Effects**: hearing loss, headache, nervousness, poor concentration.
• Vibrations	• Vibrations: exposure to noise and vibration risks may decrease, depending on takeover of specific task by cobots/robots. Vibration maybe reduced due to ecodesign of machinery operating with less vibration energy and more environmental-friendly. However, dismantling or remanufacturing upholstered furniture may pose workers still at risk of vibration.
Effects: hand-arm-vibration syndrome (e.g. white finger disease).	**Effects**: hand-arm-vibration syndrome (e.g. white finger disease).
• Laserlight	• Laserlight: exposure to laserlight 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.	Effects: eye and skin injuries resulting from a direct laser beam or a reflection of the beam.
Fire and explosion hazards	
• Fire and explosion hazards from materials, including glue, solvents and other chemicals. 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.	• Fire and explosion hazards from materials, including glue, solvents and other chemicals. 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. Risks from explosion and fire may decrease, depending on takeover of specific task by cobots/robots. Risk from explosion and fire may decrease, depending on the substitution of flammable solvents in glues. In recycling, dismantling or disassembling activities the risk of dust explosion may increase, because of dust formation (emission) and not suitable dust extraction systems.
Effects: burns, fatal accidents.	**Effects**: burns, fatal accidents.

2020 Current situation	2025-30 Situation forecast
Work environmental hazards	
• Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation. **Effect**: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.	• Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation. **Effect**: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.
Hazards through dangerous substances	
• Chemical hazards/ dangerous substances: toxic flame retardants, wood dust, solvents, preservatives, formaldehyde, glues.	• Chemical hazards/ dangerous substances: toxic flame retardants, wood dust, solvents, preservatives, formaldehyde, glues, new substances/materials. Chemical hazards may decrease depending on the substitution of dangerous substances (no toxic flame retardants in the material). Chemical hazards may increase depending on the quality of recycled materials (during successive recycling of unknown raw materials).
• Upholsterers usually require an extensive use of solvents. 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. **Effects**: contamination/intoxication, skin diseases, respiratory diseases, allergies, cancer.	• Upholsterers usually require an extensive use of solvents. 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. Exposure to chemicals may decrease, depending on takeover of specific task by cobots/robots. Exposure to chemicals may decrease depending on the integration of OSH into the design of new processes, techniques (prevention through design), substitution of dangerous substances (no toxic flame retardants in the material). **Effects**: contamination/intoxication, skin diseases, respiratory diseases, allergies, 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.
	• Recycled material may concentrate hazardous substances (impurities and hazardous flame retardants mainly in upholstery products) during successive recycling or may change the composition due to different factors such as light, heat and aging of material ~~↓~~unknown content and kind of hazardous substances. Exposure may increase when working with recycled material or performing disassembling/ dismantling activities. Workers may be exposed to dangerous substances used in former times, now restricted by law. Disassembling may also be related to an increased risk of inhaled dust. **Effects**: contamination/intoxication, skin diseases, respiratory diseases, allergies, cancer.
Biological hazards	
• Biological hazards: bacteria, mould and fungi. **Effects**: contamination/intoxication, skin diseases, respiratory diseases, infections.	• Non-targeted activities with microorganism: Remanufacturing activities: selective and/or destructive disassembling of out of use or defective upholstery articles for separation of materials and elements for further recovery or recycling may expose workers to microorganism such as mould (Recycled, old and used material may contain mould). **Effects**: contamination/intoxication, skin diseases, respiratory diseases, infections.
Psychosocial hazards	
• Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility, repetitive work.	• 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.
	• Lack of experience: New software and digital devices require training, some workers may not have enough competences and may feel overloaded, not experienced enough. Working with materials which have previously been manufactured: new skills need to be acquired throughout the production cycle. Repair, remanufacture and selective disassembly require new methods and procedures. Deciding on circular economic and sustainable oriented strategies/products/ marketing projects.
• Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues.	• Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues, lack of social contacts.
• Working method: working with colleagues.	• 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.
Effects: stress, burnout and emotional distress, suffering from depression, cardiovascular problems, sleep disorders.	**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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Upholsterer and related workers – ISCO 7534

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Shift to renewable materials	Reuse products throughout their technical lifetime	Prolong products lifetime through repair	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	Remanufacture products and/or components	Recycle materials	Promote the cascade use of wood	Apply new technologies	Using semi-automatic 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 springsuspension	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	YES, changed		●	●	●		●		●	●						
Disassemble wood-based furniture products	NEW		●	●		●	●		●	●	●		●			●
Examine disassembled pieces for further steps (reuse, recylce, upcycle)	NEW		●	●			●		●	●	●			●	●	
Repair wood-based furniture pieces, where needed	NEW		●	●			●		●	●	●		●			●
Essential knowledge																
Furniture industry	YES															
Furniture trends	YES, changed	●	●	●	●		●	●	●	●	●	●				
Textile materials	YES, changed	●					●		●	●			●		●	
Upholstery fillings	YES, changed	●					●		●	●	●		●		●	
Upholstery tools	YES, changed	●	●	●		●	●	●	●			●	●			
Generic green skills, knowledge and competences (*)																
Environmental awareness and willingness to learn	NEW	●	●	●				●	●	●	●					
Systems and risk analysis skills	NEW										●					
Innovation skills	NEW	●			●	●			●		●	●				
Coordination, management and business skills	NA															
Communication and negotiation skills	NEW	●	●	●	●		●			●	●					
Marketing skills	NA															
Strategic and leadership skills	NA															
Consulting skills	NEW	●	●	●	●		●			●	●					
Networking, information technology and language skills	NA															
Adaptability and transferability skills	NEW	●				●	●	●	●	●	●	●				
Entrepreneurial skills	NA															
Waste, energy and water quantification and monitoring	NEW		●	●		●	●	●	●		●	●				
Material use and impact quantification and monitoring	NEW	●	●	●		●	●	●	●		●	●				
Material use and impact minimisation	NEW	●	●	●	●		●		●	●	●	●				

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

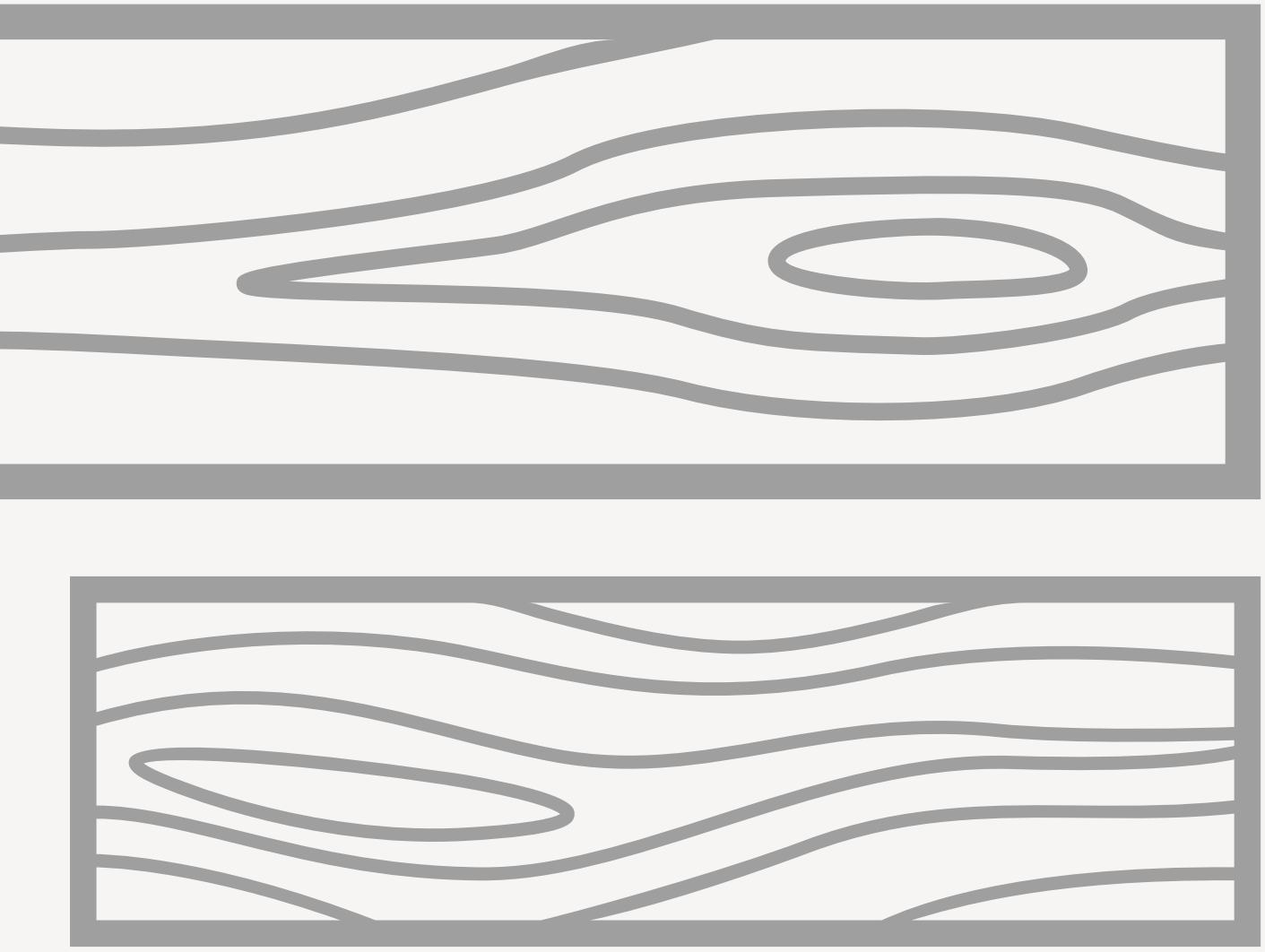
Wood processing plant operator
ISCO 8172

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.



Wood processing plant operator
ISCO 8172

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

Wood processing plant operator ISCO 8172

2020
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 profiles tasks	**ReSOLVE levers***																								
		Regenerate	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste		
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.			●												●	●	●					●	●		
H				●				●	●	●	●	●		●	●	●	●	●		●	●		●	●		

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Wood processing plant operator - ISCO 8172

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Wood processing plant operators monitor, operate and control ecoefficient, digitized, connected and automated lumber mill equipment for sawing timber logs, coming preferably from certified sustainable sources, 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.
- Uses digitization tool to work in a customer-oriented manner.
- Considers cost, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair or remanufacturing processes (e.g. waste generation or energy use reduction, etc.).

	Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	**Profile tasks forecast**
A			●		●	●	●	Examining logs and rough lumber, using fulled automated, computer vision, big data and cloud connectivity to determine size, condition, quality, source and other characteristics to decide best lumber cuts to carry out, or operate automated and ecoefficient equipment to convey logs through different sensors, like laser scanners, to determine the most productive and profitable cutting patterns, optimising the use of resources and energy and reducing to maximum the generated waste (e.g. wood scrap).
B			●		●	●		Operating and monitoring log autonomous, ecoefficient 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., using sustainable techniques and reducing as much as possible the use of hazardous substances.
D			●		●	●		Ecoefficient, 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, optimising the use of wood and the generation of waste.
E			●		●	●		Autonomous selection, controlling, mounting and replacement of cutting tools on the highly digitized connected and ecoefficient woodworking machines, optimising the use of consumables prolonging their useful life.
F			●		●	●	●	Automated operating and remote monitoring of digitized and ecoefficient plywood core-laying machines and hot-plate plywood presses and machines which cut veneer, optimising the use of raw materials and the generation of waste.
G			●		●	●		Data driven predictive maintenance and quality assurance through cleaning and lubricating of sawmill equipment, using substances with low environmental impact and optimising their consumption.
H					●	●		Operating tools and digitized, connected and automated equipment for preparing wood for the maintenance, reparation and/or re-manufacturing of wood-based products, including sawing, etc.

Wood processing plant operator ISCO 8172

2020
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 profiles 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	Laserlight	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)	Recycled material	Biological Hazards	Non-targeted activities with microorganism	Psychosocial hazards	Excessive workloads	Low job satisfaction	Work tasks not clearly defined
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.			●				●						●		●		● ●			● ●			●	●			●	●	●	●	●				●		●
H				●	●			●				●				●								●	●	●				●	●	●				●		●

● No changes ● Reduced due to Circular Economy ● New or increased due to Circular Economy ● Reduced due to digitalization ● New or increased due to digitalization

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Wood processing plant operator - ISCO 8172

	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	
A	●	●		●	●	●	●		●	●	●	Examining logs and rough lumber, using fulled automated, computer vision, big data and cloud connectivity to determine size, condition, quality, source and other characteristics to decide best lumber cuts to carry out, or operate automated and ecoefficient equipment to convey logs through different sensors, like laser scanners, to determine the most productive and profitable cutting patterns, optimising the use of resources and energy and reducing to maximum the generated waste (e.g. wood scrap).
B	●	●		●	●	●	●		●	●	●	Operating and monitoring log autonomous, ecoefficient 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., using sustainable techniques and reducing as much as possible the use of hazardous substances.
D	●	●		●	●	●	●		●	●	●	Ecoefficient, 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, optimising the use of wood and the generation of waste.
E	●	●		●	●	●	●		●	●	●	Autonomous selection, controlling, mounting and replacement of cutting tools on the highly digitized connected and ecoefficient woodworking machines, optimising the use of consumables prolonging their useful life.
F	●	●		●	●	●	●		●	●	●	Automated operating and remote monitoring of digitized and ecoefficient plywood core-laying machines and hot-plate plywood presses and machines which cut veneer, optimising the use of raw materials and the generation of waste.
G	●	●		●	●	●	●		●	●	●	Data driven predictive maintenance and quality assurance through cleaning and lubricating of sawmill equipment, using substances with low environmental impact and optimising their consumption.
H	●	●		●		●	●		●	●	●	Operating tools and digitized, connected and automated equipment for preparing wood for the maintenance, reparation and/or re-manufacturing of wood-based products, including sawing, etc.

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

Wood processing plant operators monitor, operate and control ecoefficient, digitized, connected and automated lumber mill equipment for sawing timber logs, coming preferably from certified sustainable sources, 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.
- Uses digitization tool to work in a customer-oriented manner.
- Considers cost, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair or remanufacturing processes (e.g. waste generation or energy use reduction, etc.).

Profile tasks forecast

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Wood processing plant operator - ISCO 8172

2020 Current situation	2025-30 Situation forecast
Work system/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.	Work system/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, new and recycled material, programming of machines, storing and transporting raw timber, handling heavy timber, prepare wood for reuse/re-manufacture, work with ecoefficient woodworking machines.
Mechanical hazards	
• 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).	• 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. 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. Preparing wood for reuse/remanufacturing may require new type of tools not available. Better design of products (ecodesign) could reduce hazards associated to activities on a timber yard, saw/lumber mill – using wood processing machines.
Effects: severe bruises, amputations, cuts and sharp injuries, crushing.	**Effects**: severe bruises, amputations, cuts and sharp injuries, crushing.
• Slips and trips, obstacles, table edges, moving vehicles, machines.	• Slips and trips, obstacles, table edges, moving vehicles, machines.
Effects: squeezing, cutting, twisting, spraining, bumps and bruises.	**Effects**: squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload.	• Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload, digitalization put workers at risk of inactivity because of operating autonomous techniques from office workstations. Risks from ergonomic hazards may decrease, depending on take over 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 digitalization. Preparing wood for reuse and reassembling may be related to Musculoskeletal Disorders (MSDs) (e.g. awkward positions, heavy lifting and carrying). This risk could be reduced with ecodesign strategies if occupational safety and health is taken into account when designing the product.
Effect: musculoskeletal diseases.	**Effect**: musculoskeletal diseases.
Electrical hazards	
• Electrical hazards: caused by contact with defective or unearthed electrical equipment.	• Electrical hazards: caused by contact with defective or unearthed electrical equipment and from autonomous or highly autonomous equipment.
Effect: fatal accident.	**Effect**: fatal accident.
Hazards due to physical effects/physical agents	
• Noise	• Noise: exposure to noise may decrease, depending on takeover of specific tasks by cobots/robots. The risk could be reduced with ecodesign strategies if occupational safety and health is taken into account when designing the product and machines.
Effects: hearing loss, headache, nervousness, poor concentration.	**Effects**: hearing loss, headache, nervousness, poor concentration.
• Vibrations	• Vibrations: exposure to vibration may decrease, depending on takeover of specific tasks by cobots/robots. The risk could be reduced with ecodesign strategies if occupational safety and health is taken into account when designing the product and machines.
Effects: hand-arm-vibration syndrome (e.g. white finger disease).	**Effects**: hand-arm-vibration syndrome (e.g. white finger disease).
• Laserlight	• Laserlight: wood processing plant operators may be exposed to laserlight.
Effect: eye damage, effects similar to sunburn.	**Effect**: eye damage, effects similar to sunburn.

2020 Current situation	2025-30 Situation forecast
Fire and explosion hazards	
• Fire and explosion hazards from materials, including wood dust and chemicals.	• Fire and explosion hazards from materials, including wood dust and chemicals. Exposure to fire and explosion hazards may decrease, depending on takeover of specific tasks by cobots/robots. Solvents and cleaning products used for maintenance tasks may be based on less hazardous substances (e.g. solvents) and prevent fire hazards.
Effects: burns, fatal accidents.	**Effects**: burns, fatal accidents.
Work environmental hazards	
• Work environmental hazards: poor lighting, inadequate temperature and climate.	• Work environmental hazards: poor lighting, inadequate temperature and climate.
Effect: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.	**Effect**: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.
Hazards through dangerous substances	
• Chemical hazards/dangerous substances: wood dust, preservatives, formaldehyde.	• Chemical hazards/dangerous substances: wood dust, preservatives, formaldehyde. The risk of being exposed to chemicals may decrease, depending on takeover of specific tasks by cobots/robots. Maybe reduced, if OSH will be included in the design of the products/ materials, less dangerous solvents and lubricants.
Effects: contamination/intoxication, skin diseases, respiratory diseases, wood dusts (carcinogens, allergens) may cause nasal or lung cancer.	**Effects**: contamination/intoxication, skin diseases, respiratory diseases, wood dusts (carcinogens, allergens) may cause nasal or lung 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.
	• Recycled material may concentrate hazardous substances (impurities) during successive recycling or may change the composition due to different factors such as light, heat and aging of material ~~un~~known content and kind of hazardous substances. Recycled material may contain dangerous substances, to the latest findings carcinogen or repro-toxic. (nowadays restricted by law (REACH)). **Effects**: contamination/intoxication, skin diseases, respiratory diseases, allergies, cancer.
Psychosocial hazards	
• Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility, repetitive, monotonous work.	• Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility and digital know how, repetitive, monotonous work. Lack of experience: New software and digital devices require training, some workers may not have enough competences and may feel overloaded, not experienced enough. Increased demand on competences and up-to-date knowledge on the current development in circular economy and recycling industry. Working with materials which have previously been manufactured: new skills need to be acquired throughout the production cycle.
• Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues.	• Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues, lack of social contacts.
• Working method: working with colleagues.	• 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.	**Effects**: stress, burnout.

Skills and competences needs

Forecast of training new needs due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Wood processing plant operator - ISCO 8172

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Shift to renewable materials	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	Recycle materials	Replace old materials with advanced renewable ones	Apply new technologies	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, changed	●		●		●		●			
Ensure conformity to specifications	YES, changed	●				●	●			●	●
Ensure equipment availability	YES										
Handle timber	YES, changed			●		●		●			
Handle timber-based products	YES, changed			●		●		●			
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	YES, changed			●		●					
Remove processed workpiece	NO										
Supply machine	YES										
Troubleshoot	YES, changed									●	●
Wear appropriate protective gear	YES										
Work safely with machines	YES										
Disassemble wood-based furniture products	NEW	●	●	●		●	●		●		
Examine disassembled pieces for further steps (reuse, recylce, upcycle)	NEW	●	●	●	●	●	●	●	●	●	●
Repair wood-based furniture pieces, where needed	NEW	●	●	●	●	●	●	●	●		●
Essential knowledge											
Cutting technologies	YES										
Types of wood	YES, changed	●		●		●	●				
Wood cuts	YES										
Woodworking processes	YES, changed	●	●	●	●		●	●	●	●	
Generic green skills, knowledge and competences (*)											
Environmental awareness and willingness to learn	NEW	●	●	●	●	●	●	●			
Systems and risk analysis skills	NA										
Innovation skills	NA										
Coordination, management and business skills	NA										
Communication and negotiation skills	NA										
Marketing skills	NA										
Strategic and leadership skills	NA										
Consulting skills	NA										
Networking, information technology and language skills	NA										
Adaptability and transferability skills	NEW	●	●	●	●	●	●	●			
Entrepreneurial skills	NA										
Waste, energy and water quantification and monitoring	NEW		●	●	●			●			
Material use and impact quantification and monitoring	NEW	●	●	●	●	●	●	●			
Material use and impact minimisation	NEW	●	●	●	●	●	●				

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

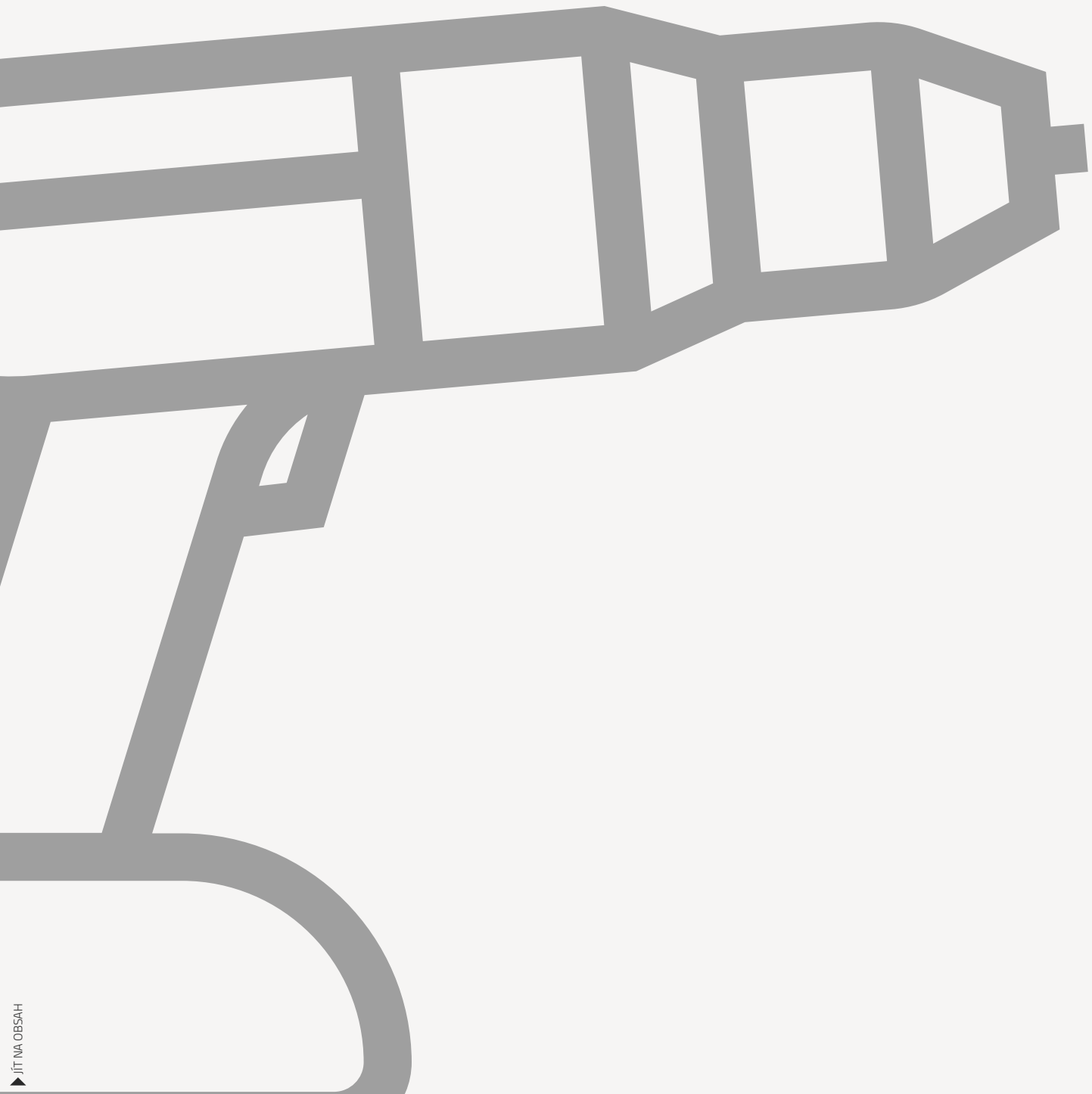
Furniture assembler
ISCO 8219s

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.



Furniture assembler
ISCO 8219s

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

Furniture assembler
ISCO 8219s

2020
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 profiles tasks	**Regenerate**	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste	
A	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…			●				●	●	●	●	●		●	●	●	●	●		●		●	●		
B	Reviewing work orders, specifications, diagrams and drawings to determine materials needed and assembly instructions.			●				●	●	●	●	●		●	●	●	●	●		●	●	●	●		
C	Recording production and operational data on specified forms.														●	●	●	●							
D	Inspecting and testing components and completed assemblies.			●				●	●	●	●	●		●	●	●	●	●		●	●	●	●		
E	Rejecting faulty products.			●											●	●	●	●		●	●	●	●		
F				●				●						●		●	●				●	●	●	●	
G				●				●	●	●	●	●		●	●	●	●	●		●	●	●	●		

ReSOLVE levers*

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Furniture assembler - ISCO 8219s

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

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.
- Uses digitization tools to work in a customer-oriented manner.
- Considers cost, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. waste generation or energy use reduction, etc.).
- Applies a life-cycle thinking and favours the future disassembly of the product for maintenance, repair, reuse or recycling.

	Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	**Profile tasks 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. • 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… • Considering the future disassembly of the product for maintenance, repair, refurbishment or recycling (e.g. reducing glued components).
B			●		●	●	●	Reviewing work orders, specifications, diagrams and drawings to determine materials needed and assembly instructions of the highly digitised enterprise ecosystem, optimising also the future disassembly of the product for repair, refurbishment or recycling.
C			●			●		Recording production and operational data of the highly digitised and ecoefficient manufacturing plant on specified digitilized forms, including environmental performance indicators.
D			●			●		Inspecting and testing components and completed assemblies to fulfill quality and circular economy-oriented requirements (e.g. disassembly sequence for maintenance, repair, etc.) as integrated part of the fully digitised smart manufacturing ecosystem of the company.
E			●			●		Supervising the highly autonomous rejection system of faulty products, reducing as much as possible the scrap generated and promoting the internal reuse of part or components.
F					●			Defining and following disassembly instructions for selective disassembling of out of use or defective wood-based products for separation of materials and elements for further recovery or recycling.
G					●	●	●	Defining and following intructions for the maintenance, reparation and/or re-manufacturing of wood-based products, including re-assembly and final quality inspection and testing.

Furniture assembler

ISCO 8219s

2020

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 profiles tasks

A	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…
B	Reviewing work orders, specifications, diagrams and drawings to determine materials needed and assembly instructions.
C	Recording production and operatio-nal data on specified forms.
D	Inspecting and testing components and completed assemblies.
E	Rejecting faulty products.
F	
G	

New categorization of hazards

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Furniture assembler - ISCO 8219s

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

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.
- Uses digitization tools to work in a customer-oriented manner.
- Considers cost, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. waste generation or energy use reduction, etc.).
- Applies a life-cycle thinking and favours the future disassembly of the product for maintenance, repair, reuse or recycling.

	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 tasks 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. • 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… • Considering the future disassembly of the product for maintenance, repair, refurbishment or recycling (e.g. reducing glued components).
B	●	●		●	●	●	●		●	●	●	Reviewing work orders, specifications, diagrams and drawings to determine materials needed and assembly instructions of the highly digitised enterprise ecosystem, optimising also the future disassembly of the product for repair, refurbishment or recycling.
C	●	●		●	●	●	●		●	●	●	Recording production and operational data of the highly digitised and ecoefficient manufacturing plant on specified digitilized forms, including environmental performance indicators.
D	●	●		●	●	●	●			●	●	Inspecting and testing components and completed assemblies to fulfill quality and circular economy-oriented requirements (e.g. disassembly sequence for maintenance, repair, etc.) as integrated part of the fully digitised smart manufacturing ecosystem of the company.
E	●	●		●	●	●	●			●	●	Supervising the highly autonomous rejection system of faulty products, reducing as much as possible the scrap generated and promoting the internal reuse of part or components.
F	●	●				●	●				●	Defining and following disassembly instructions for selective disassembling of out of use or defective wood-based products for separation of materials and elements for further recovery or recycling.
G	●	●				●	●				●	Defining and following intructions for the maintenance, reparation and/or re-manufacturing of wood-based products, including re-assembly and final quality inspection and testing.

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Furniture assembler - ISCO 8219s

2020 Current situation	2025-30 Situation forecast
Work system/work area: working on site, operate wood processing machines, use of hand and power tools to place together furniture and auxiliary items.	Work system/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, following instructions circular and economic oriented requirements, using less dangerous substances (glue, solvents, coatings), using new and recycled material. Disassemble, dismantle, repair and maintenance of products.
Mechanical hazards	
• 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).	• 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. Some risks from mechanical hazards may decrease, depending on takeover of specific tasks by cobots/robots. However, 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. Remanufacturing and selective disassembling could require new type of tools not available. Better design of products (ecodesign) could reduce hazards associated to assembly/disassembly operations, using optimised joining systems, etc.
Effects: severe bruises, cuts and sharp injuries.	**Effects**: severe bruises, cuts and sharp injuries.
• Slips and trips, obstacles, table edges.	• Slips and trips, obstacles, table edges.
Effects: squeezing, cutting, twisting, spraining, bumps and bruises.	**Effects**: squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload.	• Ergonomic hazards: from poor ergonomic conditions, awkward positions, heavy physical workload. 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. The disassembling and dismantling of manufactured goods may be related to Musculoskeletal Disorders (MSDs) (e.g. awkward positions, heavy lifting and carrying). This risk could be reduced with ecodesign strategies to facilitate assembly/disassembly (e.g. type of fasteners, etc.) if occupational safety and health is taken into account when designing the product.
Effect: musculoskeletal diseases.	**Effect**: musculoskeletal diseases.
Electrical hazards	
• Electrical hazards: contacts with live parts or connections or exposure to arc flash. Electrical hazards from woodworking machines.	• 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.	**Effect**: fatal accident.
Hazards due to physical effects/physical agents	
• Noise	• Noise: exposure to noise may decrease, depending on takeover of specific tasks by cobots/robots. Noise maybe reduced due to ecodesign of machinery operating quieter and more environmental-friendly. However, dismantling activities may expose workers still to noise.
Effects: hearing loss, headache, nervousness, poor concentration.	**Effects**: hearing loss, headache, nervousness, poor concentration.
• Vibrations	• Vibrations: exposure to vibration may decrease, depending on takeover of specific tasks by cobots/robots. Possible more use of vibrating tools during product remanufacturing or repair (polisher, etc.). Vibration maybe reduced due to ecodesign of machinery operating with less vibration energy and more environmental-friendly.
Effect: hand-arm-vibration syndrome (e.g. white finger disease).	**Effect**: hand-arm-vibration syndrome (e.g. white finger disease).
• Laserlight	• Laserlight: furniture assembler may be exposed to laserlight.
Effects: eye damage, negative effects similar to sunburn.	**Effects**: eye damage, negative effects similar to sunburn.
Fire and explosion hazards	
• Fire and explosion hazards from materials, including wood dust, solvents and chemicals.	• Fire and explosion 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. Dust maybe emitted during dismantling, remanufacturing or repair activities– inappropriate dust extraction system increases risk of dust explosion. Risk from explosion and fire may decrease, depending on the substitution of flammable solvents in glues.
Effects: burns, fatal accidents.	**Effects**: burns, fatal accidents.

2020 Current situation	2025-30 Situation forecast
Work environmental hazards	
• Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation.	• Work environmental hazards: poor lighting, inadequate temperature and climate, poor ventilation.
Effect: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.	**Effect**: negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.
Hazards through dangerous substances	
• Chemical hazards/dangerous substances: wood dust, solvents, preservatives, formaldehyde, glues, new substances/materials.	• Chemical hazards/dangerous substances: wood dust, solvents, preservatives, formaldehyde, glues, new substances/materials. Chemical risks may decrease, depending on takeover of specific task by cobots/robots. Chemical hazards may be reduced, if OSH will be included in the design of the products/ materials (use of less dangerous substances) and if dangerous substances will be substituted by less dangerous substances (solvents, glues, formaldehyde). Chemical hazards may increase depending on the quality of recycled materials (during successive recycling of unknown raw materials). Disassembling, dismantling: Exposure to fibres or dust when disassembling, dismantling products.
Effects: contamination/intoxication, skin diseases, respiratory diseases, allergies, cancer.	**Effects**: contamination/intoxication, skin diseases, respiratory diseases, allergies, 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.
	• Recycled material: Risk of exposure to dangerous substances may be increased through lack of information on chemicals contained in recycled products and on ways how to deal with them appropriately. Recycled material may contain dangerous substances, to the latest findings carcinogen or repro-toxic. (nowadays restricted by law (REACH)). **Effects**: contamination/intoxication, skin diseases, respiratory diseases, cancer.
Biological hazards	
• Biological hazards: bacteria, mould and fungi.	• Non-targeted activities with microorganism: selective and/or destructive disassembling for separation of materials and elements for further recovery or recycling may expose workers to microorganism such as mould (Recycled , old and used material may contain mould).
Effects: contamination/intoxication, skin diseases, respiratory diseases, infections.	**Effects**: contamination/intoxication, skin diseases, respiratory diseases, infections.
Psychosocial hazards	
• Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility, repetitive and monotonous work.	• Organisation of work: time pressure, lack of experience, training and information, increased demand on flexibility and digital know how, repetitive and monotonous work.
	• Lack of experience: New software and digital devices require training, some workers may not have enough competences and may feel overloaded, not experienced enough. Increased demand on competences and up-to-date knowledge on the current development in circular economy and recycling industry. Working with materials which have previously been manufactured: new skills need to be acquired throughout the production cycle. Repair, remanufacture and selective disassembly require new methods and procedures.
• Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues.	• Social relationship: lack of involvement in making decisions that affect the worker, difficult colleagues, lack of social contacts.
• Working method: working with colleagues.	• 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	**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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Furniture assembler - ISCO 8219s

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Shift to renewable materials	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	Recycle materials	Promote the cascade use of wood	Apply new technologies	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 digitilized 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, changed	●	●						●			
Assemble prefabricated furniture	YES, changed	●	●				●	●	●	●		
Clean wood surface	YES, changed	●			●		●		●			
Create furniture frames	YES, changed	●	●	●	●		●	●	●			
Create smooth wood surface	YES, changed	●	●						●			
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									●		
Disassemble wood-based furniture products	NEW				●		●	●	●	●		
Examine disassembled pieces for further steps (reuse, recylce, upcycle)	NEW				●		●	●			●	
Repair wood-based furniture pieces, where needed	NEW			●	●		●	●	●	●		
Essential knowledge												
Technical drawings	YES, changed										●	
Generic green skills, knowledge and competences (*)												
Environmental awareness and willingness to learn	NEW	●	●	●	●	●	●	●	●			
Systems and risk analysis skills	NA											
Innovation skills	NA											
Coordination, management and business skills	NA											
Communication and negotiation skills	NA											
Marketing skills	NA											
Strategic and leadership skills	NA											
Consulting skills	NA											
Networking, information technology and language skills	NA											
Adaptability and transferability skills	NEW	●	●	●	●	●	●	●	●			
Entrepreneurial skills	NA											
Waste, energy and water quantification and monitoring	NEW	●		●	●	●		●	●			
Material use and impact quantification and monitoring	NEW	●		●	●	●	●	●	●			
Material use and impact minimisation	NEW	●	●		●	●	●	●	●			

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

Factory hand
ISCO 9329

You will find three different types of tables for each occupational profile, where the forecasted changes due to sector circular economy transition are in green colour and due to sector digitalization are in blue colour.

Tasks changes
Current and forecasted tasks changes.

Hazards and risks changes
Current and forecasted risks changes.

Skills and competences need
Forecast of training new needs.

Factory hand
ISCO 9329

Unfold this to see the current occupational profile description and its tasks and to relate them to the following green table and first yellow table.

Tasks changes

Hazards and risks changes

Hazards and risks comments

Skills and competences needs

Factory hand ISCO 9329

2020
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 profiles tasks		**ReSOLVE levers***																								
		Regenerate	Shift to renewable energies	Shift to renewable materials	Reclaim, retain, and regenerate health of ecosystems	Return recovered biological resources to the biosphere	**Share**	Reduce product replacement speed and increase product utilisation by sharing it among different users	Reuse products throughout their technical lifetime	Prolong products lifetime through maintenance	Prolong products lifetime through repair	Prolong products lifetime through design for durability	**Optimise**	Increase performance/efficiency of products	Customisation/made to order	Reproductible and adaptable manufacturing	Minimize waste in production and supply chain	Increase efficiency of production processes	**Loop**	Remanufacture products and/or components	Implement take-back programs	Recycle materials	Promote the cascade use of wood	Promote extraction of biochemicals from organic waste	
A	Conveying goods, material, equipment and other items to work areas, and removing finished pieces.														●	●	●	●		●	●				
B	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.														●	●		●							
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.			●										●	●	●	●	●				●	●		
G				●				●						●		●	●				●	●	●	●	

*McKinsey center and Ellen MacArthur Foundation

Tasks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Factory hand - ISCO 9329

2025/30

Occupational profile

Description forecast of the occupational profile in 2030

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, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. waste generation or energy use reduction, etc.).

	Virtualise	Virtualise direct aspects of the product	Virtualise indirect aspects of the product	**Exchange**	Replace old materials with advanced renewable ones	Apply new technologies	Choose new products and services	**Profile tasks forecast**
A			●			●		Conveying goods, material, equipment and other items to highly digitized, connected and automated work areas, and removing finished pieces, applying sustainable working practices (e.g. waste management, etc.).
B			●		●	●		Digitally verifying technical & environmental specifications of goods, material, equipment and other items and checking the quality in order to ensure adherence to these specifications.
C			●			●		Loading and unloading vehicles, trucks and trolleys in a digital and ecoefficient manufacturing plant, reducing the impact of logistics (e.g. load optimisation, etc.).
D			●			●	●	Clearing machine blockages, and cleaning machinery, equipment and tools when predictive maintenance and online realtime monitoring could not prevent this; using non-hazardous substances, reducing their consumption and making a proper management of the generated waste.
E			●			●		Carrying out semi-automated sorting of products or components when necessary in highly digitized and ecoefficient factory.
F			●		●	●		Recording operational data of the digital and ecoefficient factory on specified forms, including environmental performance indicators.
G					●			Following disassembly instructions and using adequate tools for destructive disassembling of out of use or defective wood-based products for separation of materials and elements to future recovery or recycling.

Factory hand ISCO 9329

2020
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.

New categorization of hazards

Current profiles tasks		**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	Laserlight	**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)	Recycled material	**Biological Hazards**	Non-targeted activities with microorganism	**Psychosocial hazards**	Excessive workloads	Low job satisfaction	Work tasks not clearly defined
A	Conveying goods, material, equipment and other items to work areas, and removing finished pieces.		●	●	●		●			● ●	● ●	●				●	● ●	● ●					●	●	●		●			●	●				●	●	●
B	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.		●	●	●		●			● ●	● ●	●				●	● ●	● ●					●	●	●		●			●	●				●	●	●
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.																● ●						●	●											●	●	●
G			●	●	●	●	●			●	●	●			●		●	●					●	●	●		●	●	●	●	●		●	●	●	●	●

● No changes ● Reduced due to Circular Economy ● New or increased due to Circular Economy ● Reduced due to digitalization ● New or increased due to digitalization

Hazards and risks changes

Current and forecasted tasks changes due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Factory hand - ISCO 9329

	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 tasks forecast
A	●	●	●			●	●	●	●		●	Conveying goods, material, equipment and other items to highly digitized, connected and automated work areas, and removing finished pieces, applying sustainable working practices (e.g. waste management, etc.).
B	●	●		●		●	●		●	●	●	Digitally verifying technical & environmental specifications of goods, material, equipment and other items and checking the quality in order to ensure adherence to these specifications.
C	●	●	●			●	●	●	●		●	Loading and unloading vehicles, trucks and trolleys in a digital and ecoefficient manufacturing plant, reducing the impact of logistics (e.g. load optimisation, etc.).
D	●	●				●	●	●	●		●	Clearing machine blockages, and cleaning machinery, equipment and tools when predictive maintenance and online realtime monitoring could not prevent this; using non-hazardous substances, reducing their consumption and making a proper management of the generated waste.
E	●	●	●		●	●	●	●	●	●	●	Carrying out semi-automated sorting of products or components when necessary in highly digitized and ecoefficient factory.
F	●	●			●	●	●		●	●	●	Recording operational data of the digital and ecoefficient factory on specified forms, including environmental performance indicators.
G	●	●	●	●		●	●					Following disassembly instructions and using adequate tools for destructive disassembling of out of use or defective wood-based products for separation of materials and elements to future recovery or recycling.

2025/30
Occupational profile

Description forecast of the occupational profile in 2030

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, environmental impact 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 and sustainability activities.
- Assists in the reduction of the environmental impact of the manufacturing, repair, remanufacturing or recycling processes (e.g. waste generation or energy use reduction, etc.).

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 circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Factory hand – ISCO 9329

2020 Current situation	2025-30 Situation forecast
Work system/work area: working on site, cleaning and tidying up the workshop and machines, passing tools and materials, storage activities, supporting machine operators.	Work system/work area: working on site, cleaning and tidying up the workshop and machines, passing tools and materials, storage activities, supporting machine operators, loading and unloading activities, using digitalized instruments, collecting and sorting generates waste following sustainable and ecological requirements, using less hazardous materials , support in disassembling, repair and dismantling of furniture.
Mechanical hazards	
• Mechanical hazards from moving machines and tools and means of transportation, uncontrolled moving parts and parts with dangerous shapes.	• Mechanical hazards from moving machines and tools and means of transportation, uncontrolled moving parts and parts with dangerous shapes. Hazards from moving cobots/robots. 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. Support in remanufacturing and selective disassembling of furniture could require new type of tools not available. Better design of products (ecodesign) could reduce hazards associated to assembly/disassembly operations, using optimised joining systems, etc.
Effects: severe bruises, amputations, cuts and sharp injuries, crushing, roll over or being crushed by means of transportation, forklift trucks etc.	**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.	• Slips and trips, obstacles, table edges, moving vehicles, machines.
Effects: squeezing, cutting, twisting, spraining, bumps and bruises.	**Effects**: squeezing, cutting, twisting, spraining, bumps and bruises.
Ergonomic hazards	
• Ergonomic hazards: from poor ergonomic conditions, awkward position, confined spaces, handling heavy loads.	• Ergonomic hazards: from poor ergonomic conditions, awkward position, confined spaces, handling heavy loads. Risks from ergonomic hazards may decrease, depending on take over 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 as well as repetitive movements due to operating digitized machinery. Support in remanufacturing and repair services as well as dismantling of manufactured goods may be related to Musculoskeletal Disorders (MSDs) (e.g. awkward positions, heavy lifting and carrying). The risk of heavy loads may be reduced for factory hands due to use of lighter materials. Exposure to awkward positions may be reduced for workers if occupational safety and health is taken into account from the beginning, when the machinery is designed.
Effect: musculoskeletal diseases.	**Effect**: musculoskeletal diseases.
Electrical hazards	
• Electrical hazards: caused by contact with defective or unearthed electrical equipment.	• Electrical hazards: caused by contact with defective or unearthed electrical equipment. Electrical hazards from woodworking machines and from autonomous or highly autonomous equipment.
Effect: fatal accident.	**Effect**: fatal accident.
Hazards due to physical effects/physical agents	
• Noise: sawmill, other wood processing machines.	• Noise: sawmill, other wood processing machines. Exposure to noise and vibration may decrease, depending on takeover of specific tasks by cobots/robots. Noise maybe reduced due to ecodesign of machinery operating quieter and more environmental-friendly. However, noise during support of repair, dismantling or remanufacturing furniture may still be a risk.
Effects: hearing loss, headache, nervousness, poor concentration.	**Effects**: hearing loss, headache, nervousness, poor concentration.
• Vibrations	• Vibrations: exposure to vibration may decrease, depending on takeover of specific tasks by cobots/robots. Vibration maybe reduced due to ecodesign of machinery operating with less vibration energy and more environmental-friendly. However, vibrations during support of repair, dismantling or remanufacturing furniture may still be a risk.
Effect: hand-arm-vibration syndrome (e.g. white finger disease).	**Effect**: hand-arm-vibration syndrome (e.g. white finger disease).

2020 Current situation	2025-30 Situation forecast
Fire and explosion hazards	
• Fire and explosion hazards from materials, including wood dust and chemicals.	• Fire and explosion from materials, including wood dust and chemicals. Exposure to fire and explosion hazards may decrease, depending on takeover of specific tasks by cobots/robots. Dust maybe emitted during support of dismantling activities – inappropriate dust extraction system increases risk of dust explosion. Fire hazards of solvents when cleaning machinery, equipment and tools may be reduced due to new cleaning products based on less flammable substances such as water.
Effect: burns, fatal accidents.	**Effect**: burns, fatal accidents.
Work environmental hazards	
• Work environmental hazards: excessive heat and cold, poor lighting.	• Work environmental hazards: excessive heat and cold, poor lighting.
Effects: cardiovascular diseases, negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.	**Effects**: cardiovascular diseases, negative effects on muscles, tendons and joints, cold, poor concentration, eye strain.
Hazards through dangerous substances	
• Chemical hazards/dangerous substances: asbestos, glass fibre, vapours, fumes, dust, solvents.	• Chemical hazards/dangerous substances: asbestos, glass fibre, vapours, fumes, dust, solvents. The risk of being exposed to chemicals may decrease, depending on takeover of specific tasks by cobots/robots Maybe reduced, due to products/materials used for cleaning machinery, equipment and tools based on less dangerous substances.
Effects: contamination/intoxication, skin diseases, respiratory diseases, cancer.	**Effects**: contamination/intoxication, skin diseases, respiratory diseases, cancer.
	• New materials (e.g. nanomaterials): ranotechnology 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.
	• Recycled material: risk of exposure to dangerous substances may be increased through lack of information on chemicals contained in recycled products and on ways how to deal with them appropriately. Recycled material may contain dangerous substances, to the latest findings carcinogen or repro-toxic. (nowadays restricted by law (REACH)). **Effects**: contamination/intoxication, skin diseases, respiratory diseases, cancer.
Biological hazards	
• Biological hazards: bacteria, mould and fungi.	• Non-targeted activities with microorganism: support of selective and/or destructive disassembling for separation of materials and elements for further recovery or recycling may expose workers to microorganism such as mould (recycled, old and used material may contain mould).
Effects: contamination/intoxication, skin diseases, respiratory diseases, infections.	**Effects**: contamination/intoxication, skin diseases, respiratory diseases, infections.
Psychosocial hazards	
• 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.	• 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.
	• Lack of experience: new software and digital devices require training, some workers may not have enough competences and may feel overloaded, not experienced enough. Increased demand on competences and up-to-date knowledge on the current development in circular economy and recycling industry: Repair, remanufacture and selective disassembly require new methods and procedures.
• Social relationship: Lack of involvement in making decisions that affect the worker.	• 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, working with colleagues.	• 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. 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 digitalized tools may change the task for factory hand totally and require new training and competences.
Effects: stress, burnout.	**Effects**: stress, burnout.

Skills and competences needs

Forecast of training new needs due to sector circular economy transition (in green for 2030) and digitalization (in blue for 2025) for the occupational profile: Factory hand – ISCO 9329

Skills, knowledge and competences	Will it continue to be needed?	Main causes/reasons of change: Customisation/made to order	Reproductible and adaptable manufacturing	Increase efficiency of production processes	Apply new technologies	Working in highly digitized, connected and automated work areas	Step in 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	YES, changed				●		
Maintain work area cleanliness	YES, changed					●	●
Supply machine	YES, changed	●	●	●		●	●
Supply machine with appropriate tools	YES, changed					●	
Wear appropriate protective gear	YES						
Disassemble wood-based furniture products	NEW		●		●	●	●
Examine disassembled pieces for further steps (reuse, recylce, upcycle)	NEW		●	●	●	●	●
Essential knowledge							
Cleaning products	YES, changed			●	●		
Cleaning techniques	YES, changed			●	●	●	
Industrial tools	YES, changed					●	●
Generic green skills, knowledge and competences (*)							
Environmental awareness and willingness to learn	NEW		●	●	●		
Systems and risk analysis skills	NA						
Innovation skills	NA						
Coordination, management and business skills	NA						
Communication and negotiation skills	NA						
Marketing skills	NA						
Strategic and leadership skills	NA						
Consulting skills	NA						
Networking, information technology and language skills	NA						
Adaptability and transferability skills	NEW		●	●	●		
Entrepreneurial skills	NA						
Waste, energy and water quantification and monitoring	NA						
Material use and impact quantification and monitoring	NA						
Material use and impact minimisation	NEW		●		●		

(*) Source: Strietskallina et al. and Dr. Margarita Pavlova

Finsko
bit.ly/39qFe6o

Švédsko
bit.ly/2Xywndm

Norsko
bit.ly/3i91XI1

Velká Británie
bit.ly/2XzY1XB

Dánsko
bit.ly/38CyqmW

Irsko
bit.ly/39I6duz

Nizozemsko
bit.ly/3qj5Woy

Belgie
bit.ly/3i8MRlW

Švýcarsko
bit.ly/3i8eoE5

Lichtenštejnsko
bit.ly/3qgl8T7

Francie
bit.ly/2Lw2Ezp

Portugalsko
bit.ly/3bGGsNP

Španělsko
bit.ly/2XBbGxn

Itálie
bit.ly/2LI5nvD

Bosna a Hercegovina
bit.ly/35DH42J

Černá Hora
bit.ly/3ibgy64

Albánie
bit.ly/35CGimv

Mapování iniciativ EU v oblasti cirkulární ekonomiky

Strategie cirkulární ekonomiky se v evropských městech, regionech a zemích rozvíjí již několik let. Od r. 2014 bylo přijato 33 strategií a na dalších nejméně 29 strategiích se pracuje.

Vytvořili jsme specifickou zprávu „Sbírka důležitých iniciativ na podporu cirkulární ekonomiky v EU", která se nesnaží být vyčerpávajícím seznamem, ale přináší příklady různých přístupů na podporu oběhového hospodářství v několika zemích EU. Většina z nich se zaměřuje na efektivní využívání zdrojů a redukci odpadů, ale některé iniciativy pokrývají i cíle udržitelného rozvoje nebo změnu klimatu. Celou zprávu najdete na: bit.ly/2KqAu8l

Odkazy v této mapě vám umožní přístup ke specifickým zprávám, které vytvořil EIONET a které obsahují přehled zásad, přístupů a cílů 32 evropských zemí k vlastnímu efektivnímu využívání zdrojů a cirkulární ekonomice a jejich stupeň rozvoje.

Dalšími důležitými zdroji informací této zprávy o iniciativách, strategiích a analýze souvisejících s cirkulární ekonomikou jsou:

- Strategie cirkulární ekonomiky a plány v Evropě: Identifikace synergií, potenciální spolupráce a budování aliancí – Studie Evropského hospodářského a sociálního výboru: bit.ly/2NchxqZ
- Evropská platforma zainteresovaných stran pro oběhové hospodářství: bit.ly/3bRv8hM

Estonsko
bit.ly/3oJJrsc

Lotyšsko
bit.ly/3ibevP2

Litva
bit.ly/3svHRN8

Polsko
bit.ly/3qglh97

Německo
bit.ly/3qhY6vi

Česká republika
bit.ly/2N2m67h

Slovensko
bit.ly/2LspqrS

Rakousko
bit.ly/2LHqt74

Maďarsko
bit.ly/3nDPhtV

Slovinsko
bit.ly/2LwEMeO

Chorvatsko
bit.ly/39wj2b9

Srbsko
bit.ly/35BPwQd

Turecko
bit.ly/3nF8A6b

Bulharsko
bit.ly/2LwMjKF

Severní Makedonie
bit.ly/2LqUfgs

Závěr

Výrobců nábytku věnujících se cirkularitě a oběhovým praktikám bude čím dál tím více, protože cirkulární ekonomika je klíčem k řešení klimatických a environmentálních výzev a v odvětví se na ni budou neustále zvyšovat požadavky. Cirkularita je v raných fázích a bude patrná ve střednědobém a dlouhodobém horizontu.

Přechod na cirkulární ekonomiku usnadní dvě nedávné iniciativy EU. Na jedné straně je to Zelená dohoda pro Evropu (COM(2019) 640 v konečném znění), jež podpoří a urychlí přechod průmyslu EU na udržitelný model s inkluzivním růstem, a na druhé straně nový Akční plán pro oběhové hospodářství (COM(2020) 98 v konečném znění), v němž je nábytkářský průmysl speciálně uveden jako jedna z prioritních produktových skupin v kontextu hodnotových řetězců, na něž se tento plán zaměřuje.

Prohlášení o vizi projektu SAWYER na r. 2030 je následující:

*Do r. 2030, s široce **digitalizovaným nábytkářským průmyslem**, bude výroba dřevěného nábytku nabízet **produkty a služby** s **designem ohleduplným vůči životnímu prostředí** založeným na **nízkém dopadu a vysledovatelných surovinách, udržitelných výrobních postupech**, podpoře **nejlepšího využití a scénářů pro obnovu** materiálů a vyřazených produktů. Zákazníci (B2B nebo B2C) budou vyžadovat podrobnější informace o produktech a jejich **udržitelných charakteristikách**, včetně ukazatelů životního cyklu. Klíčem k úspěšnému dosahování cílů cirkulární ekonomiky bude posílení postavení spotřebitelů. Úřady (na místní, národní a evropské úrovni) cirkulární ekonomiky podpoří **udržitelnými scénáři pro konec životnosti** materiálů a dřevěných výrobků rozšiřováním **státních a soukromých programů zadávání zelených zakázek** a podporou **politik pro efektivní využívání materiálů**.*

V analýze implementované v projektu SAWYER vykázaly specifické faktory/akce vyšší dopad na většinu hodnocených profilů povolání, například:

- Přesunout se k obnovitelným materiálům,
- Opětovně využívat výrobky během jejich technické životnosti,
- Prodlužovat životní cyklus výrobků opravami,
- Prodlužovat životní cyklus výrobků pomocí designu pro odolnost,
- Zvyšovat výkon/účinnost produktů,
- Zvyšovat efektivitu výrobních procesů,
- Repasovat výrobky a/nebo díly,
- Recyklovat materiály,
- Podporovat kaskádové využívání dřeva,
- Virtualizovat nepřímé aspekty výrobku,
- Nahrazovat staré materiály za technicky vyspělé, obnovitelné,
- Používat nové technologie.

Ke zvládnutí výzev transformace k oběhovému hospodářství a využití nabízených příležitostí se zúčastněné strany v nábytkářském průmyslu EU budou muset na tento přechod dívat jako na součást **dvojí transformace** odvětví (zelené a digitální), protože ty s sebou úzce souvisí. Jak předpověděly výsledky projektu DIGIT-FUR, průmysl výroby nábytku bude nabízet chytré produkty na míru založené na digitálních výrobních systémech dodaných udržitelnými průmyslovými sektory efektivně využívajícími zdroje. Řada technologií (např. levné pokročilé snímače, internet věcí/průmyslový internet věcí, internet nové generace, analýza dat, umělá inteligence, virtuální a rozšířená realita, kolaborativní roboti atd.) nabídne podnikům transformační potenciál jak ohledně produktů, které lze vyvíjet a vyrábět, tak ohledně samotného výrobního procesu – pro ty, kteří jsou schopni je používat. Další náročnou výzvou pro dřevozpracující nábytkářský průmysl bude poskytnout pracovníkům nezbytné dovednosti, aby mohli digitální transformaci účinně zvládat. Celkově budou mít technologie průmyslu 4.0 v příštích letech velký vliv na výrobní procesy v tomto sektoru a přinesou mu s přerodem na cirkulárnější ekonomiku užitek.

Z celkového pohledu by dvojí transformace odvětví měla představovat referenční rámec pro všechny budoucí analýzy tohoto průmyslu, inovace produktů a výrobních postupů firem, inovativní obchodní modely, sektorové politiky a následně společenský dialog v odvětví.

Z pohledu digitalizace se nábytkářský průmysl se rychle mění z tradičního na počítačově řízený průmysl. Na základě očekávaných změn v analyzovaných profilech povolání – za použití McKinseyho zásad a s přihlédnutím na technologie Průmyslu 4.0 – dojde podle prognózy projektu DIGIT-FUR ke **změnám v poptávce po dovednostech, znalostech a kompetencích** pracovníků. Budoucí zaměstnanci v nábytkářském průmyslu budou muset nejet efektivně vykonávat úkoly, ale mít i dovednosti a schopnosti rozpoznat neustálé změny a přizpůsobit se jim. Požadovaná úroveň kvalifikace se zvýší a bude specializovanější, protože jádro dovedností bude následkem digitalizace/komputerizace abstraktnější.

Nebude narůstat potřeba průmyslových dovedností. Průmyslové či technické dovednosti však musí plně integrovat (všechny relevantní) digitální dovednosti. Technické znalosti zůstávají zásadní a tvoří základ; kognitivní, sociální a behaviorální dovednosti se stanou prioritou. Lidé již nebudou vybíráni na základě diplomu, ale podle jejich přístupu. Každý jednotlivec bude zodpovědný za pokroky v sebevzdělávání a sebezdokonalování.

U některých profilů povolání budou vyžadovány **nové zelené dovednosti**, protože budou existovat nové, specifické úkoly související s demontáží a opětovným využitím, repasováním, recyklováním a upcyklací. Tyto nové dovednosti budou zvlášť důležité u úkolů „praktických" profilů povolání. Patří k nim:

- demontáž nábytkářských výrobků ze dřeva,
- prostudování demontovaných dílů k dalším krokům (opětovnému využití, repasování, recyklaci, upcyklaci),
- oprava dílů dřevěného nábytku tam, kde je to potřeba.

Tyto nové zelené dovednosti budou mít také vliv, i když ne tak výrazný, na ty profily, které firmy řídí a provádějí v nich strategická rozhodnutí. Tyto dovednosti završují stávající nezbytné ZDK pro sledované profily povolání.

Obecné zelené dovednosti, znalosti a kompetence byly navíc stanoveny jako nezbytné pro společenský, ekonomický a environmentální vývoj v dřevozpracujícím nábytkářském průmyslu. Jsou sladěny s klíčovými kompetencemi nebo měkkými dovednostmi (tzv. soft skills), které jsou uvedeny do kontextu environmentální informovanosti a pochopení udržitelného vývoje a cirkulární ekonomiky.

Dvojí transformace nábytkářského průmyslu s sebou nese **nové výzvy pro bezpečnost a ochranu zdraví při práci.** Nábytkářský průmysl může být **skutečně udržitelný** (z hlediska životního prostředí, společensky a ekonomicky) pouze tehdy, je-li zajištěna bezpečnost, zdraví a duševní pohoda jeho **nejdůležitějších zdrojů, tedy pracovníků** – nebo přinejmenším nemůže být udržitelný bez co nejúčinnější ochrany jejich bezpečnosti a zdraví.

Bezpečnost a zdraví pracovníků mohou ovlivnit **nové typy pracovišť, nové procesy, nové technologie a nové materiály/produkty**. Nicméně pokud budou řádně naplánovány a používány, **ochranu zdraví a bezpečnost lze jasně zlepšit**. Z pohledu digitalizace mohou roboti a digitální technologie dělat fyzicky náročnou a monotónní práci jednodušeji, efektivněji a bezpečněji. Pracovníci mohou být odvoláni z nebezpečných prostředí a snímače mohou automaticky ukazovat, zda stroj potřebuje údržbu, čímž se sníží riziko vzniku havárií a úrazů. Obvyklá nebezpečí v nábytkářském průmyslu jako nebezpečné látky, prach, nebezpečné stroje a nástroje budou i nadále existovat, ale riziko expozice těmto rizikům se sníží.

Analýza ukazuje, že přechod k cirkulárnější ekonomice **zlepší globální životní prostředí**, ale za žádných okolností by neměl redukovat bezpečnost pracovníků a ochranu jejich zdraví. Z tohoto důvodu musíme my, zúčastněné strany v nábytkářském průmyslu, zajistit, aby tato transformace s novými technologiemi a pracovními postupy nevedla k novým rizikům. A musíme také zajistit, aby nové a recyklované materiály nemohly zaměstnance ohrozit „novými" či skrytými nebezpečnými látkami**.** Pokud bude shodně dbáno na BOZP a ochranu životního prostředí, měla by být **cirkulární ekonomika v tomto průmyslu zavedena prostřednictvím bezpečnějších a efektivnějších strojních zařízení, pracovních postupů a materiálů**, jež sníží chemická a fyzikální rizika pro pracovníky. Uplatňování **ekodesignu** u produktů by mělo usnadňovat jejich obnovu a opravy a snižovat ergonomická rizika. A rovněž snižovat obsah nebezpečných látek a redukovat tak v celém hodnotovém řetězci chemická rizika. Bezpečnost a zdraví pracovníků by se mohly zlepšit začleněním BOZP do systémů řízení kvality firem.

Pokud nebude dvojí transformace nábytkářského průmyslu vedena a zavedena řádným způsobem, mohla by pracovníkům způsobit nové výzvy a problémy se stresem. Narůstající pracovní zátěž a složitost úkolů, příliš dlouhá pracovní doba a neustálá dostupnost zapříčiňují rostoucí napětí a trápení v práci vedoucí k psychosociálním rizikům (EUOSHA, 2015). K prevenci těchto nových rizik je skutečným a hlavním klíčem pro všechny pracovníky v odvětví **nabytí nových poznatků, schopností a flexibility**, aby mohli řádně zvládat narůstající automatizaci, nové procesy a vývoj nových produktů.

Výsledky těchto analýz projektu SAWYER jsou užitečné také pro:

- řádné porozumění tomu, jak se budou pracovní pozice pracovníků a jejich bezpečnost vyvíjet vzhledem k dopadu přechodu na cirkulární ekonomiku na průmysl,
- přípravu firem a pracovníků, aby mohli čelit nastávajícím změnám a příležitostem a využít je a
- silnější základ pro budoucí debaty a spolupráci v rámci evropského sociálního dialogu.

Tyto kombinované analýzy dvojí transformace také ukázaly na relevantní synergie mezi digitalizací a cirkularitou. Vztahují se například k tomu, jak:

- ~~je~~ třeba získávat a sdělovat environmentální informace o výrobcích (např. obsah nebezpečných látek, znovu použitelné díly, recyklovatelné materiály atd.) v celém dodavatelském řetězci, až k zákazníkům nebo pracovníkům recyklace,
- ~~se~~ posunout od produktů ke službám (virtualizace, dematerializace, servitizace atd.),
- ~~s~~nižovat dopad výrobních procesů na životní prostředí pomocí nových technologií (např. energetickou efektivitou, snižováním množství odpadů, optimalizací surovin atd.).

Tato analýza synergií posiluje vizi, že budoucí nábytkářský průmysl EU bude dvojí transformací ovlivněn velkou měrou a zúčastněné strany budou muset zvládat výzvy související s digitalizací a cirkularitou ekonomiky k co nejlepšímu využití všech příležitostí, které se jim nabízejí.

Doporučení

Cesta k cirkulární ekonomice **vyžaduje spolupráci různých aktérů** – tvůrců politik, průmyslových hráčů, odborníků, akademiků a spotřebitelů. K aktivaci a urychlení přechodu k cirkulárnější ekonomice by se měla rozšířit **průmyslová nabídka cirkulárnějších produktů** spolu s **poptávkou trhu a spotřebitelů** po takových výrobcích. K dosažení výše uvedeného **hrají klíčovou roli poskytovatelé odborného vzdělávání a přípravy a tvůrci politik** v podpoře těchto dvou hlavních trendů. Z toho důvodu najdete v dalších částech tohoto dokumentu různá konkrétní doporučení pro tvůrce politik a systém odborného vzdělávání a přípravy VET k jejich podpoře v dosahování těchto důležitých cílů.

Přes výše uvedená fakta a to, že několik doporučení se zaměřuje na zvládání výzev přechodu k cirkulárnější ekonomice v nábytkářském průmyslu, je důležité brát vždy na vědomí, že na praktické úrovni bude toto odvětví zároveň ovlivněno dvojí transformací (digitální a zelenou). Zúčastněným stranám v sektoru tak musí být umožněno řešit jeho problémy, ale zejména úspěšně využívat příležitostí, které jim nabízí konkrétní, společný dopad těchto transformací.

Tvůrci politik

K zajištění úspěšného přechodu na cirkulárnější ekonomiku v rámci dvojí transformace sektoru je třeba **zavést harmonizovaná pravidla na úrovni EU / mezinárodně** a konzistentně implementovat iniciativy EU **ze strany členských států**, aby se snížilo riziko fragmentace vnitřního trhu, **zabránilo vzniku bariér** a uvolnil se volný pohyb udržitelného a udržitelnějšího zboží v oběhovém hospodářství.

K zajištění hladké implementace iniciativ EU jsou potřeba **jednoduchá a chytrá pravidla pro cirkulární ekonomiku, jasné definice** na úrovni EU a **společný jazyk**, zejména u parametrů měřících cirkularitu jako „dlouhá životnost", „opětovné využití", „recyklovatelnost" a další. To je klíč k **poskytování harmonizovaných informací spotřebitelům**. Iniciativa EU Politika pro udržitelné výrobky by měla poskytnout objasnění a pravidla pro tuto tematiku. Jedním z jejích základních kamenů bude rozšíření rozsahu směrnice o ekodesign, aby zahrnovala i výrobky nesouvisející s energií, jako je nábytek. Kvůli širokému rozsahu výrobků považovaných za „nábytek" a nejrůznějším materiálům používaným při jeho výrobě se k tomuto **sektoru přistupuje obtížně**. Kritéria pro ekodesign/oběhový design nefungují pro všechny produkty stejně. V tomto kontextu bude důležité vzít na vědomí složitost nábytkářského průmyslu a potřebu **postupného přístupu** v **harmonizaci** na evropské **legislativní úrovni** a **napříč politikami**; v průmyslu by také měl probíhat **dialog**. (bit.ly/3a0Gihs)

Co se týče bariér cirkulárního designu, **hlavní hlediska k jejich překonání** jsou dostupnost **náhradních materiálů a dílů** a rovněž **informací od dodavatelů** o látkách vzbuzujících obavy, dále pak přísná vnitrostátní nařízení vedoucí k používání nechtěných chemikálií (jako například toxických látek zpomalujících hoření, které musí často odpovídat požadavkům na hořlavost). V tomto rámci by iniciativa EU Strategie pro udržitelnost a udržitelné výrobky v oblasti chemických látek měla propagovat **redukci látek vyvolávajících obavy** v nábytkářských výrobcích a tím i snížení expozice chemickým látkám ze strany pracovníků. Jak zdokumentoval Svaz pro nábytek bez látek zpomalujících hoření (safefurniture.eu), tyto látky se z výrobků dostávají ven, hromadí se v prostředí a jejich používání tak jde proti cílům oběhového hospodářství. Tyto chemické látky neprokázaly užitek pro bezpečnost hoření a existuje velká průkaznost jejich škodlivých účinků na **lidské zdraví a zdraví pracovníků**, vyšší **toxicity při hoření** a vlivu na životní prostředí (bit.ly/2Y6beHN // bit.ly/2KLXjni). Pro pracovníky ve výrobě, obchodu a zpracování produktů na konci jejich životnosti přestavují **zbytečné riziko**. Jde o běžné riziko pro čalouníky a očekává se, že **se sníží nebo zmizí** s **přechodem** průmyslu na cirkulárnější ekonomiku, a pokud nadcházející nástroje utvářející politiky osloví toto nepotřebné **používání toxických látek zpomalujících hoření** v nábytku.

V rámci dvojí transformace sektoru bude jeho přechod k oběhovému hospodářství záviset také na dalších parametrech, jako je **větší digitalizace, inovativní nástroje** a **probíhající úsilí o inovaci a výzkum**. Toto úsilí a investice do cirkulárního charakteru a vývoje technologií ohleduplnějších k životnímu prostředí by měly být podporovány **finančními programy** jako Horizon Europe apod. Tento přechod by měly usnadnit příslušné investice; měly by zajistit, aby do něj byly zahrnuti všichni aktéři, zvláště malé a střední firmy, a podpořit spolupráci mezi firmami a zúčastněnými stranami. Nová průmyslová strategie EU by měla podporovat a usnadňovat dvojí transformaci a zároveň sledovat možnosti digitalizace a cirkulárního charakteru průmyslu.

Iniciativy jako Zelená dohoda pro Evropu nebo Akční plán pro oběhové hospodářství by měly **stimulovat tržní poptávku a nabízet cirkulární výrobky**, podporovat **rozvoj nových obchodních modelů**, například „výrobku jako služby", opětovné využití, repasování, přepracování, recyklaci, modely nevlastnění, modely založené na péči, opravách a repasování, opětovném nákupu a zakázkách B2B.

Vzhledem k ohromnému dopadu pandemie COVID-19 by se měly snahy institucí EU a členských států zaměřit na zotavení ze sociální a ekonomické krize a použít balíček na oživení ekonomiky (např. Next Generation EU, Recovery and Resilience Facility a European Social Fund Plus) také na boj proti změně klimatu, podporu digitalizace a oběhové ekonomiky a **školení pro pracovníky o nových technologiích a zelených dovednostech**, a to zejména pracovníky s nízkou úrovní dovedností, ženy, migranty, mládež a starší pracovníky.

Odborné vzdělávání a příprava (VET)

Vzdělání je silou budoucnosti, protože je jedním z nejsilnějších nástrojů změny. Jedním z našich největších problémů je to, jak přeměnit náš způsob myšlení, abychom zvládali výzvy stále složitějšího světa. Musíme změnit náš způsob organizace poznatků. To znamená rozbít tradiční bariéry mezi jednotlivými disciplínami. Musíme **nově navrhnout naše vzdělávací politiky a programy**. A se zaváděním těchto reforem musíme sledovat **dlouhodobý horizont** a plnit naši ohromnou odpovědnost vůči budoucím generacím.

Dvojí transformace nábytkářského průmyslu vytváří **poptávku po nových, specifických kompetencích a dovednostech** pracovní síly. Předjímání a vytváření dovedností pro budoucnost je na tomto rychle se měnícím a zelenajícím pracovním trhu zásadní. Platí to o všech změnách typů a úrovní nezbytných dovedností a změnách v povoláních a technických oblastech.

Současné dovednosti často neodpovídají této poptávce po nových a adaptovaných dovednostech. Existuje **zřetelná mezera mezi dovednostmi** potřebnými pro dvojí transformaci nábytkářského průmyslu **a současnou vzdělávací nabídkou a zajištěním**.

UNESCO popsalo pět rozměrů „zezelenání" technického a odborného vzdělávání a přípravy, **Five Dimensions of Greening TVET**, jako promítnutí **tří rozměrů udržitelnosti**, které je třeba oslovit – **ekologického, ekonomického a společenského** – do klíčového rámce pro porozumění přístupu ke vzdělávání pro udržitelný rozvoj.

Ve vztahu k dvojí transformaci jsme přidali ještě hledisko digitalizace.

Na základě těchto pěti rozměrů zezelenání TVET doporučujeme následující:

Zelený a digitální kampus

Správa kampusu vzhledem k řízení spotřeby energie a vody, odpadů a znečištění.

- Je téměř **nemožné, aby školy a školicí střediska stačila na veškeré investice** potřebné následkem dvojí transformace, protože nové technologie se vyvíjejí stále rychleji.

Proto by se měl zelený a digitální kampus zaměřit i na **hybridní vzdělávací prostředí**, i ve formálním školení, na nabídku výuky v praxi, duální výuku a učňovství. Zelený a digitální kampus investuje do digitálních výukových metod, e-learningu prostřednictvím online kurzů MOOCS (Massive Open Online Courses) a zelených vzdělávacích programů.

Zelený a digitální kampus je **otevřený kampus**, kde mohou najít své místo start-upy a kde jsou společnosti vítány jako partneři, kteří budou investovat do nových technologií, zeleného výzkumu a nových, flexibilních vzdělávacích programů.

Zelený a digitální vzdělávací program

Integrace vzdělávání pro udržitelný rozvoj (ESD). Zelené technologie, čisté technologie, zelená pracovní místa a zelenající stávající místa. Je tu proto třeba zelených programů a kurzů, zelených praktik ve třídách a seminářích a lepší interakce mezi průmyslovými odvětvími a vzdělávacími institucemi.

Systémy odborného vzdělávání a přípravy se musejí **přizpůsobovat a neustále vyvíjet** (chytrým způsobem).

Následující příklady předkládáme jako inspiraci k získání zelených či zelenějších dovedností.

- Adaptace informací pracovního trhu o zelenající a digitální ekonomice při rozvoji nových vzdělávacích programů a revize stávajících programů na základě zelených a digitálních hledisek. To mohou v odvětví provádět rady, poradní orgány s kapitány (zeleného) průmyslu, propagátoři digitalizace nebo poradní výbory s místními podnikateli (pro regionální přizpůsobení, kontext a místní trh práce apod.).

- K zavedení oběhového hospodářství do vzdělávacích programů škol odborné přípravy (VET), by podniky mohly navštěvovat školy a hovořit o způsobu, jakým vyrábějí své produkty. Poté by žákům/studentům své výrobky předaly, aby je nově navrhli z pohledu cirkulární ekonomiky (circlevet.eu – Steve Parkinson).

- Návrhy a adaptace či úprava vzdělávacích programů by měla reagovat na měnící se potřeby u dovedností pro dvojí transformaci, a dokonce je předjímat. Díky návrhům programů a úpravě kurzů a výsledků výuky ve vzdělávacích programech vytvořených **modulárním** způsobem nebo **založených na školení v rámci pracovního procesu** lze začleňovat poptávku po nových dovednostech velmi pružně. Mnoho kurzů a programů se již nyní upravuje k integraci (některých) aspektů oběhového hospodářství, udržitelnosti a/nebo digitalizace. Ale velmi často k tomu dochází jen mimochodem a příliš omezeně. Například o používání dřeva z udržitelných zdrojů se často učí pouze v teoretických hodinách, ale není součástí zásob dřeva používaného v dílnách. Digitalizace je ve výuce pouze pojem, teorie, a často není součástí strojních dílen, kde jsou zastaralé počítače, nevhodné pro náročné aplikace virtuální/rozšířené reality.

- Kromě adaptace studijních plánů pro studenty potřebujeme také přizpůsobit vzdělávací dráhy pro rekvalifikaci a školení v rámci pracovního procesu pro zvýšení a obnovu dovedností pracovníků.

- Dalším důležitým prvkem pro zavádění výše uvedených doporučení pro vzdělávací programy je průběžné odborné vzdělávání a příprava (CVET). Výše uvedené **nové metody výuky** (modulární, praxe na pracovišti, webová distanční, hybridní, školení mimo kampus apod.) lze použít k nabídce **požadovaných a personalizovaných vzdělávacích drah** pro kohokoli, kdo o to má zájem. Je důležité adaptovat metodu pro konkrétní cílové skupiny a zaměřit se na měnící se mentalitu, spíše než se věnovat čistě technickým záležitostem.

- Dvojí transformace se musí šířit všemi odděleními a být začleněná do všech větví a všech školicích programů a studijních plánů.

Takový integrovaný, udržitelný přístup může tvořit:

- Rozvoj dovedností nezbytných k **implementaci** udržitelných a digitalizovaných řešení,
- Vytváření spojení mezi zvoleným programem / studijním plánem a dvojí transformací,
- Být součástí vzájemně propojených, světových systémů,
- Ucelené porozumění sociálním, ekonomickým a environmentálním systémům a debatování o praktických řešeních pro dvojí transformaci,
- Udržitelné přemýšlení a rozhodování přispívající k řešení společenské, ekologické a hospodářské krize,
- Zapojování studentů do výuky „pro" dvojí transformaci a nikoli jen „o" ní.

Zelená a digitální komunita

Přizpůsobování komunity pomocí budování kapacit, obnovitelných technologií a podpory vyžívání zdrojů.

K účinným metodám předjímání budoucích potřeb u dovedností patří trvalý dialog mezi zaměstnavateli a zaměstnanci, společnostmi a školiteli, koordinace napříč státními institucemi, informačními systémy trhu pracovních sil, službami personálních agentur a hodnoceními výkonu institucí odborné přípravy. Je potřeba spolupráce a kooperace na všech úrovních (činitelé s rozhodovací pravomocí, tvůrci politik, praxe, organizace atd.). Existuje zde ohromná potřeba **zahrnout všechny zúčastněné skupiny**, vzdělávací instituce, sociální partnery (firmy, zaměstnavatele, zaměstnavatelské svazy a konfederace), vysoké školy a akademický svět, sektorové organizace, úřady práce a partnery ve veřejné správě (ministerstvo školství, práce, životního prostředí, digitalizace atd.). K uznávání dovedností je například nutné vytvořit **tzv. aliance dovedností v rámci odvětví, ale i napříč sektory**.

Zelený a digitální výzkum

Podpora výzkumu v oblastech obnovitelných energií, zelených inovací a recyklace odpadů.

Ve vztahu k dvojí transformaci doporučujeme více společných akcí ohledně **výzkumu uznávání dovedností prováděných mimo běžné učební dráhy**. Toto uznávání – které se stává čím dál tím důležitější – musí být transparentní a musí ho podporovat všechny zúčastněné strany včetně partnerů ze státní správy. Pouhých pár let po střední/vysoké škole se získané znalosti a dovednosti stávají kvůli rychle se měnícímu prostředí ve světle dvojí transformace jaksi zastaralé. Trvalou validaci diplomu/titulu zaručí pouze průběžné odborné vzdělávání a příprava (Continous VET), ať už ve formální, neformální či zájmové podobě.

Zelená a digitální kultura

Propagace kultury zelených hodnot, zeleného přístupu, zelené etiky a zelené praxe.

Vzhledem ke dvojí transformaci bychom chtěli přidat i **digitální kulturu** (digitální přístup, digitální etiku a digitální praxi).

Vedle této zelené a digitální kultury doporučujeme ve firmách přizpůsobit **kulturu vzdělávání** a integrovat do ní neformální a zájmovou výuku. Pracovníci potřebují čas nebo být uvolněni z práce, aby se řádně naučili novým věcem a přinesli tak svým firmám užitek. Zaměstnanci se mohou učit při práci a po celý svůj pracovní život díky flexibilním a modulárním vzdělávacím dráhám, při výuce v provozu či mimo něj, v praxi na pracovišti, právě tam, kde je to potřeba, (na správném místě a ve správném formátu) nebo kdykoli je to nutné (v pravý čas). Výzvou je to, aby lidé, kteří se učí, **měli přístup ke kvalitním informacím** (viz digitální gramotnost). Dostatečnou pozornost je třeba věnovat i pracovní síle s vysokým vzděláním. Tito zaměstnanci budou také odpovědní za vyškolení pracovníků s méně dovednostmi. **Očekávání ohledně učení** a **příležitostí k učení vzrůstá**.

Zelené dovednosti

Studie týkající se budoucí poptávky po dovednostech často potvrzují zmiňovanou důležitost sociálních dovedností, schopnosti spolupracovat a digitálních kompetencí. Definované obecné zelené dovednosti také odkazují na tyto měkké dovednosti.

Potřebné digitální kompetence a obecné zelené dovednosti se o mnoho neliší. Často jde o kontext a situaci, cíl nebo záměr, který vychází z různého pohledu. V následující tabulce jsou znázorněny (nové) definované obecné zelené dovednosti (vlevo) a potřebné digitální dovednosti (vpravo) tak, jak byly stanoveny v projektu Digit-Fur. Protože digitální dovednosti byly definovány obecnějším způsobem než obecné zelené dovednosti (které jsou podrobnější), můžeme digitální dovednosti vztáhnout k zeleným dovednostem (kurzívou) víckrát.

Kromě těchto obecných měkkých dovedností musíme začlenit a zakotvit i technické zelené a/nebo digitální dovednosti.

Tabulka 9. Nové zelené dovednosti a jejich vztah k digitálním dovednostem

Informovanost o životním prostředí a ochota se učit	Digitální gramotnost
Systémy a dovednosti týkající se analýz rizik	Kritické myšlení a řešení problémů
Dovednosti týkající se inovací	Zvídavost a inovativnost
Koordinační, manažerské a obchodní dovednosti	*Iniciativnost a podnikavost*
Komunikační a vyjednávací schopnosti	Efektivní komunikace
Marketingové dovednosti	*Efektivní komunikace*
Strategické a vedoucí schopnosti	*Iniciativnost a podnikavost*
Poradenské schopnosti	*Efektivní komunikace*
Dovednosti týkající se networkingu, informačních technologií a jazykové dovednosti	Spolupráce napříč sítěmi
Přizpůsobitelnost a schopnost přenášet dovednosti	Agilita a přizpůsobitelnost
Podnikatelské schopnosti	Iniciativnost a podnikavost
Kvantifikace a monitorování odpadů a spotřeby energie a vody	Získávání informací
Kvantifikace a monitorování používání materiálů a jejich dopadu u zadávání zakázek a výběru	*Získávání informací*
Minimalizace používání materiálů a jejich dopadu (hodnocení dopadu)	*Získávání informací*

Formální VET

Formální odborné vzdělání a příprava je širší než jen orientace na trh pracovních sil a nadále zůstává důležité. Nová, vyšší **poptávka po správných sociálních dovednostech musí být podporována** silněji. I přes důležitost těchto měkkých dovedností by systém neměl ztratit ze zřetele **základní technické kompetence**, potřeba aktualizovaného technického vzdělávání platí totiž i nadále. Člověk může být ve své práci kreativní, pouze pokud má základní dovednosti.

- Proto je nezbytná **větší spolupráce** školství a nábytkářského průmyslu, zvláště na technických programech. Budoucí zaměstnanci musí být schopni nejen efektivně provádět své úkoly, ale mít také **dovednosti a schopnosti k tomu, aby rozpoznali nadcházející změny a přizpůsobili se jim**. Role multidisciplinárních dovedností a schopností značně roste a **firmy budou vyžadovat vyšší a specializovanější úrovně kvalifikací**.
- Posun kompetencí také podtrhuje **důležitost profesních kvalifikačních profilů** (stanovených odvětvím) **jako základu pro vzdělávací dráhy** ve školství.

Počáteční VET oproti průběžnému VET

- Narůstá důležitost **systémů založených na poptávce**, jako je učňovská výuka, duální výuka nebo učení v rámci pracovního procesu. Tyto systémy musí být implementovány do obou systémů VET.
- Stávající systémy počátečního a průběžného odborného vzdělávání a přípravy (VET) potřebují **přijmout nové zelené a digitální technologie**. Partneři ve vzdělávání a poskytovatelé školení musí úzce spolupracovat s podniky. U dvojí transformace jsou potřeba nejen technické dovednosti a specializované poznatky o konkrétní oblasti. Definované obecné měkké dovednosti jsou zrovna tak důležité.

Závěrem můžeme shrnout, že pro moderní **výukový systém** potřebujeme **spolupráci** všech zúčastněných stran a partnerů k úspěšnému zavedení a integraci nových nezbytných dovedností pro tuto dvojí transformaci. Tato spolupráce vyžaduje, aby se pozornost a jednání všech zainteresovaných stran zaměřily doplňkovým a kolaborativním způsobem.

Je třeba spolupráce mezi **regulačními subjekty pro VET a státními vzdělávacími subjekty** k začlenění nových dovedností pro zelený a digitální svět již v rané fázi, jako je základní školství, a tyto dovednosti je nutno dále rozvíjet ve středním školství.

Je potřebná spolupráce mezi **poskytovateli vzdělávání a školení a firmami** k poskytnutí flexibilních a adaptivních vzdělávacích drah, v provozu i mimo něj, v rámci pracovního procesu, právě tam, kde je to potřeba (na správném místě a ve správném formátu) a kdy je to potřeba (v pravý čas).

Je třeba spolupráce mezi **sociálními partnery pracovníků a sdruženími** k podpoře a usnadnění podmínek, které zaměstnancům umožní získávat nezbytné dovednosti a zdatnost, aby mohli čelit dvojí transformaci sektoru. **Pracovní síla** v tomto odvětví bude muset změnit mentalitu a průběžně se učit (celoživotní vzdělávání). Bude muset neustále aktualizovat své znalosti ohledně nových rizik BOZP a příslušně jednat. Celkově se jednotlivci stanou do budoucna odpovědní za své vlastní dovednosti a zdatnost.

Společně, v partnerství mezi zaměstnavateli, vládou a vzdělávacími institucemi, můžeme pracovat na rozvoji požadovaných dovedností pro dvojí transformaci, abychom předem budovali a posílili dovednosti všech zúčastněných stran (učitelů, studentů, rodičů, zaměstnavatelů, spolupracovníků, státní správy atd.). Tímto způsobem nás v nábytkářském průmyslu čeká světlá budoucnost.

Protože v budoucnu budou všechna pracovní místa zelená a digitální!

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