AIVET

THE LOCAL LABOUR MARKETS OF VOCATIONAL EDUCATION AND TRAINING GRADUATES IN EUROPEAN CITIES: REVIEW REPORT ON BARCELONA, SOFIA AND VIENNA

Project AIVET

Developing AI tools for sharing intelligence

on the local labour markets of VET graduates.

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Executive summary

AIVET will examine different types of information that may potentially underpin the design of vocational education and training (VET) programmes. The project focuses on three European cities. Barcelona has become a well-known tourist destination in the last decades and has also developed clusters of info- and bio- technology. Vienna has been a global city for more than a century. Sofia is the most dynamic regional economy in Bulgaria. These three cases will likely reveal common challenges and opportunities to frame VET in each urban context.

The review traces the loop that links VET systems and skills and labour market intelligence. The idea is that the former contributes to shaping the latter while the latter is necessary to evaluate the programmes of the former. Ideally, reforms should result from evaluations that draw on this intelligence. But the connections in both directions eventually rely on sets of social relationships between students, teachers, employment officers, policy makers and employers. VET systems are the institutional outcomes of very complex sets of relationships between these social actors. The project will focus on the sets of relationships that are involved in measurement and in the configuration of students' pathways.

The review partially answers two sets of research questions.

A first set has to do with measurement. What measures do the actual operations of VET systems produce? How do the involved social actors use these measures? The academic literature review, the grey literature reviews and the descriptions of the databases provide answers to the first question and partially cover the second one.

- Experts have developed information systems for VET (IS-VETs) that either target individual students who must make a choice (e.g., using data from professional social media) or inform decision-makers of the current conditions of VET systems and labour markets (e.g., using official registers and surveys). While the former type provides timely information, the second one delivers more reliable measures of the labour market.
- In Barcelona, Sofia and Vienna, the governance of VET systems is increasingly operating at the local level. In the three cities, the stakeholders of the VET system increasingly need IS-VETs to underpin strategic planning. Although the network of

stakeholders is larger and denser in Vienna, the corresponding networks of Barcelona and Sofia are spreading and becoming more active. Ongoing legal reforms are expected to widen apprenticeships and facilitate recognition of prior learning in Bulgaria and Spain. Despite the well-established tradition of planning in Austria, even Vienna needs to elaborate on its own tools because the labour market and the demographic composition of the city differ from the whole country.

- According to the description of the databases in the three cities, the available data, monitoring reports and publications only capture the key dimensions of the CEDEFOP (2024) model partially. At the local level, while intelligence on employment trends and future jobs is available, skills and learning, digitalisation and workplace trends remain elusive. Online job advertisements also provide a source of local information, which sheds light on skills and learning. However, the report can hardly conclude that this information covers such an indispensable theme as the articulation of VET programmes with the needs of employers.

The state of the art regarding the first set of questions leads to a call for reflection. Certainly, CEDEFOP has mapped out the concept of skills intelligence, and many authorities and stakeholders are collecting relevant information. However, the available measures are not clearly rooted in meaningful conventions that really help the providers, students and regulators of VET to perform their tasks.

The second research question delves into the pathways of students. Where do they come from? Where are they going? To what extent are they active agents of their pathway?

The following list of findings summarises the main results of the statistical analysis of the Integrated Databank, provided by the Catalan Council of Chambers of Commerce:

- Students who have only finished low secondary education (ISCED2) and students with a higher academic background (e.g., ISCED3) choose different upper-secondary school-based IVET programmes.
- The factors of access to either upper-secondary IVET or tertiary-level HVET programmes have varied in recent years.
- The socio-economic level of the neighbourhood seems to greatly contribute to enrolment in private schools.

- The patterns of overage enrolment are complex and variable in IVET and HVET programmes depending on the specialties.

- Different students do internships in the public, private and the third economic sectors. Generally, public- school and female students are more likely to gain professional experience in the public sector. However, specialties or vocational families also play a significant role.

- VET graduates do not have the same opportunities to find high-quality jobs, with middle-class and male students being advantaged compared to the other ones. Although specialties of vocational families reduce this gap, this variable does not counteract the general effect.

- The probability of finding a job related to the student's specialty varies along socio-demographic lines. A remarkable result is that gender does not influence this variable. In contrast, job relevance is much lower among those living in low-income neighbourhoods, doing internships in the public and the third sectors, being overage, coming from a foreign country and graduating from upper-secondary IVET programmes. However, the health and IT fields stand out for favouring job relevance.

The review report sets a baseline for the subsequent work packages of project AIVET, which will design an AI tool that strengthens IS-VETs and triangulate sources of information about the labour markets of VET graduates. Additionally, the report delivers two interesting lessons.

Firstly, since IS-VETs hinge on coordination arrangements among authorities, employers, schools and other stakeholders of VET, various local databases collect information about students and graduates in different cities. An important contribution of an AI tool may be assessing the comparability of these databases.

Secondly, encompassing IS-VETs must cover several dimensions. Quick changes of the demand for certain occupations in social media are as relevant as slower but fine-grained trends of employment at variable geographical scales. An initial exploration of the Integrated Databank elaborated by the Catalan Council of Chambers of Commerce in Barcelona has shown that consistent IS-VETs must consider inequalities. A key takeaway of AIVET is that inequalities are significant not only between types of programmes (e.g. those run by school systems and public employment services) but also within the same type of programmes, as seen in Barcelona with divides related to socio-economic background, gender, age and

nationality. An AI tool that verifies the robustness and correctness of statistical analyses conducted in different local databases may strengthen the potential for these sources to deliver sound labour market and skills intelligence about the opportunities of VET graduates.

Резюме

AIVET ще изследва различни типове информация, които потенциално могат да послужат за създаването на програми за професионално образование и обучение (ПОО). Проектът се фокусира върху три европейски града. Барселона се превърна в добре позната туристическа дестинация през последните десетилетия и също така разви клъстери от информационни и биотехнологии. Виена е глобален град повече от век. София е най-динамичната регионална икономика в България. Тези три случая вероятно ще разкрият общи предизвикателства и възможности за създаване на ПОО в конкретен градски контекст.

Анализът проследява веригата, която свързва системите на ПОО и уменията, от една страна, а от другаоснован на данни подход за изследване на пазара (market intelligence)пазара на труда. Идеята е, че първото допринася за оформянето на второто, докато второто е необходимо за оценка на програмите на първото. В идеалния случай реформите трябва да произтичат от оценки, които се основават на тази логика. Но връзките и в двете посоки в крайна сметка разчитат на набор от социални взаимоотношения между студенти, учители, служители по заетостта, политици и работодатели. Системите за ПОО са институционален резултат от много сложни взаимоотношения между тези социални актьори. Проектът ще се фокусира върху мрежите от връзки, които участват в измерването и в конфигурацията на житейските и професионалните траектории на учениците.

Анализът отговаря частично на две групи изследователски въпроси.

Първият набор от въпроси е свързан с измерването. Какви измерители произвежда настоящото функциониране на системите за ПОО? Как участващите социални актьори използват тези измерители? Анализът на академичната литература, прегледът на други литературни източници и описанията на базите данни дават отговори на първия въпрос и частично покриват втория.

∉ Експертите са разработили информационни системи за ПОО (ИС-ПОО), които са насочени или към отделни ученици, които трябва да направят избор (напр., като използват данни от професионални социални медии), или информират вземащите решения за конкретното състояние на системите за ПОО и пазарите на труда (напр., като използват официални регистри и

проучвания). Докато първият тип предоставя актуална информация, вторият осигурява по-надеждни измервания на пазара на труда.

⊄ В Барселона, София и Виена управлението на системите за ПОО все повече се осъществява на местно ниво. В трите града заинтересованите страни в системата на ПОО все повече се нуждаят от ИС-ПОО, за да подкрепят стратегическото планиране. Въпреки че мрежата от заинтересовани страни е по-голяма и по-гъста във Виена, съответните мрежи в Барселона и София се разпространяват и стават по-активни. Очаква се настоящите правни реформи да разширят чиракуването и да улеснят признаването на предишно обучение в България и Испания. Въпреки добре установената традиция на планиране в Австрия, дори Виена трябва да разработи свои собствени инструменти, тъй като пазарът на труда и демографският състав на града се различават от тези, характерни за цялата страна.

⊄ Според описанието на базите данни в трите града, наличните данни, докладите за мониторинг и публикациите обхващат само частично ключовите измерения на модела на CEDEFOP (2024). На местно ниво, въпреки че има налична информация за тенденциите в заетостта и бъдещите работни места, уменията и обучението, цифровизацията и тенденциите на работното място остават неясни. Онлайн обявите за работа предоставят и източник на местна информация, която хвърля светлина върху уменията и ученето. Докладът обаче трудно може да заключи, че тази информация обхваща такава ключова тема като съчетаването на програмите за ПОО с нуждите на работодателите.

Известното до момента по отношение на първия набор от въпроси изисква тяхното по-задълбочено осмисляне. Разбира се, CEDEFOP е очертал концепцията за основан на данни подход за изследване и развитие на уменията (skill intelligence) и много институции и заинтересовани страни събират съответната информация. Наличните измерители обаче не са ясно формулирани в смислени концепции, които наистина да подпомагат предлагащите ПОО, учениците и регулаторните органида изпълняват своите задачи.

Вторият изследователски въпрос се съсредоточава върху траекториите на учениците. Откъде идват? Къде отиват? До каква степен те са активни актьори при формирането на житейските им траектории?

Следният списък с констатации обобщава основните резултати от статистическия анализ на Интегрираната банка данни, предоставена от Каталунския съвет на търговските камари:

- Учениците, които са завършили само прогимназиално образование (ISCED2) и учениците с по-висока академична подготовка (напр. ISCED3) избират различни училищни програми за ППОО.

- Факторите за достъп до гимназиално ППОО или програми за висше ППОО варират през последните години.

- Социално-икономическото състояние на квартала изглежда че допринася значително за записването в частни училища.

- Моделите на свръхзаписване са сложни и променливи в програмите за ППОО и ВПОО в зависимост от специалностите.

- Учениците осъществяват стажуването си по различен начин в частния, публичния и неправителствения сектор. Като цяло ученичките в държавните училища и жените са по-склонни да придобиват професионален опит в публичния сектор. Въпреки това, специалностите или професиите в семействата също играят важна роля.

- Завършилите ПОО нямат същите възможности да намерят висококвалифицирана работа, като учениците от средната класа и мъжете са в по-добри позиции в сравнение с останалите. Въпреки че специалностите на професионалните групи намаляват тази разлика, тази променлива не противодейства на общия ефект.

- Вероятността за намиране на работа, свързана със специалността на ученика, варира по социално-демографски признак. Забележителен резултат е, че полът не влияе на тази променлива. За разлика от това, вероятността за намиране на подходяща работа е много по-ниска сред живеещите в квартали с ниски доходи, стажуващите в публичния и неправителствения сектор, идващите от чужда държава и завършващите гимназиални ППОО програми. Въпреки това областите на здравеопазването и ИТ се открояват с това, че благоприятстват намирането на подходяща работа.

Докладът поставя основата на следващите работни пакети на проекта AIVET, в рамките на който ще бъде разработен инструмент с изкуствен интелект, с който да се

подкрипи ИС-ПОО и да се триангулират източниците на информация за пазарите на труда на завършилите ПОО. Същевременно докладът съдържа два важни извода.

На първо място, налице са множество разнородни бази данни съдържащи информация за ПОО. Причината за това е, че ИС-ПОО зависи от различните договорености за координация между властите, работодателите, училищата и други заинтересовани страни от ПОО. Важен принос на AI инструмент може да бъде оценката на сравнимостта на тези бази данни.

Второ, обхващането на ИС-ПОО в цялост трябва да включва няколко измерения. Бързите промени в търсенето на определени професии в социалните медии са също толкова уместни, колкото и по-бавните, но фини тенденции на заетостта в различни географски мащаби. Първоначалното проучване на Интегрираната банка данни, разработена от Каталунския съвет на търговските камари в Барселона, показа, че последователните на ИС-ПОО трябва да вземат предвид неравенствата. Ключов извод от AIVET е, че неравенствата са значителни не само между видовете програми (напр. тези, управлявани от училищни системи и публични служби по заетостта), но също и в рамките на един и същи тип програми, както се вижда в Барселона с различия, свързани със социално-икономически произход, пол, възраст и националност. Инструмент с изкуствен интелект, който проверява надеждността и коректността на статистическите анализи, извършени в различни местни бази данни, може да засили потенциала на тези източници да предоставят надеждна информация за пазара на труда и уменията и така да очертаят възможностите на завършилите ПОО.

Resumen ejecutivo

AIVET examinará varios sistemas de información que podrían servir de base para el diseño de programas de formación profesional. El proyecto se centra en tres ciudades europeas: Barcelona, que se ha convertido en un conocido destino turístico en las últimas décadas y que ha desarrollado también núcleos de tecnología de la información y la biotecnología; Viena, que ha sido una ciudad global durante más de un siglo; y Sofía, la economía regional más dinámica de Bulgaria. Estos tres casos probablemente revelarán desafíos y oportunidades comunes para enmarcar la formación profesional en un contexto urbano determinado.

El estudio analiza el vínculo entre la organización de laFP y la información disponible sobre las competencias de las personas graduadas y sobre el mercado laboral. En principio, el esquema organizativo debería configurar dicha información, la cual ésta es necesaria para evaluar el sistema. Las reformas deberían ser el resultado de unas evaluaciones que se basaran en esta información, pero las conexiones en ambas direcciones dependen en última instancia de conjuntos de relaciones sociales entre estudiantes, profesores, funcionarios de empleo, responsables de políticas y empleadores. Los sistemas institucionales de FP son el producto de conjuntos muy complejos de relaciones entre estos actores sociales. El proyecto se centrará en los conjuntos de relaciones que intervienen en la medición y en la configuración de las trayectorias de los estudiantes.

La revisión responde parcialmente a dos conjuntos de preguntas de investigación.

Un primer conjunto de cuestiones tiene que ver con la medición. ¿Qué medidas generan los registros oficiales de las operaciones de los sistemas de FP? ¿Cómo utilizan estas medidas los actores sociales implicados? La revisión de la literatura académica, las revisiones de la literatura gris y las descripciones de las bases de datos proporcionan respuestas a la primera pregunta y cubren parcialmente la segunda.

∉ Los expertos han desarrollado sistemas de información para la FP que o bien se dirigen a los estudiantes individuales que deben tomar una decisión (por ejemplo, utilizando datos de las redes sociales profesionales) o bien informan a los responsables de la toma de decisiones sobre las condiciones actuales de los sistemas de FP y los mercados laborales (por ejemplo, utilizando registros y encuestas

oficiales). Mientras que el primer tipo proporciona información oportuna, el segundo proporciona mediciones más fiables del mercado laboral.

∉ En Barcelona, Sofía y Viena, la gobernanza de los sistemas de EFP se realiza cada vez más a nivel local. En las tres ciudades, los actores políticos de la FP recurren con frecuencia a los datos para diseñar planes estratégicos. Aunque la red de actores es más grande y densa en Viena, en Barcelona y Sofía la actividad de y la colaboración entre estos actores son crecientes . A primera vista, las reformas legales en curso pueden ampliar los programas de aprendizaje y facilitar el reconocimiento del aprendizaje previo en Bulgaria y España. A pesar de la tradición bien establecida de planificación en Austria, incluso Viena necesita desarrollar sus propias herramientas porque el mercado laboral y la composición demográfica de la ciudad difieren de las del resto del país.

∉ Según la descripción de las bases de datos de las tres ciudades, los datos disponibles, los informes de seguimiento y las publicaciones solo reflejan parcialmente las dimensiones clave del modelo CEDEFOP (2024). A nivel local, si bien se dispone de información sobre las tendencias del empleo y los empleos futuros, los datos sobre las competencias y el aprendizaje, la digitalización y las tendencias en el lugar de trabajo siguen siendo difíciles de obtener. Los anuncios de empleo en línea proporcionan una fuente de información local que arroja luz sobre las competencias y el aprendizaje. Sin embargo, el informe difícilmente puede concluir que esta información cubra un tema tan indispensable como la articulación de los programas de FP con las necesidades de los empleadores.

Las respuestas al primer conjunto de preguntas que el informe ha alcanzado invitan a la reflexión. Es cierto que el CEDEFOP ha definido el concepto de "skills intelligence" y que muchas autoridades y partes interesadas están recopilando información pertinente. Sin embargo, las medidas disponibles no están claramente arraigadas en convenciones significativas que al fin y al cabo ayuden a los proveedores, estudiantes y reguladores de la FP a cumplir con sus funciones.

La segunda pregunta de investigación apunta a los itinerarios de los estudiantes. ¿De dónde vienen? ¿Hacia dónde van? ¿En qué medida son agentes activos de su itinerario?

La siguiente lista resume los principales resultados del análisis estadístico del Banc Integrat de Dades, elaborado por el Consell Català de Cambres de Comerç:

- Los estudiantes que sólo han terminado la educación secundaria obligatoria (CINE2) y los estudiantes con un nivel académico más alto (por ejemplo, CINE3) eligen diferentes programas de FP basados en la escuela secundaria superior.
- Los factores de acceso a los Ciclos Formativos de Grado Medio (CFGM) y a los Ciclos Formativos de Grado Superior (CFGS) han variado en los últimos años.
- El nivel socioeconómico del barrio parece contribuir en gran medida a la elección de escuelas privadas.
- El alumnado mayor que la edad teórica del curso se matricula de manera diferent en los CFGMs y los CFGSs según la familia profesional.
- Los y las estudiantes realizan prácticas en el sector público, privado y en el tercer sector económico. Dos colectivos tienen más probabilidades de adquirir experiencia profesional en el sector público: las mujeres y el alumnado de escuelas públicas. Sin embargo, las familias profesionales también desempeñan un papel importante.
- Los titulados en FP no tienen las mismas oportunidades de encontrar empleo de calidad, siendo los estudiantes de clase media y los varones los que tienen más ventaja que el resto. Aunque las familias profesionales reducen esta brecha, esta variable no contrarresta el efecto general.
- La probabilidad de encontrar un empleo relacionado con la especialidad del estudiante varía según criterios sociodemográficos. Un resultado destacable es que el género no influye en esta variable. Por el contrario, la pertinencia laboral es mucho menor entre quienes viven en barrios de renta baja, realizan prácticas en el sector público y en el tercer sector, tienen una edad superior a la media, proceden de un país extranjero y se han graduado en programas de FP de bachillerato. Sin embargo, los ámbitos de la salud y la informática destacan por favorecer la pertinencia laboral.

El informe establece una base para los paquetes de trabajo posteriores del proyecto AIVET, que diseñarán una herramienta de inteligencia artificial que fortalezca los sistemas de información y triangularán las fuentes de información sobre los mercados laborales de los graduados de FP. Además, el informe ofrece dos lecciones interesantes.

En primer lugar, dado que la coherencia de los sistemas de formación profesional depende de acuerdos de coordinación entre autoridades, empleadores, escuelas y otras partes interesadas en la formación profesional, varias bases de datos locales recopilan información sobre estudiantes y graduados en diferentes ciudades. Una contribución

importante de una herramienta de IA puede ser la evaluación de la comparabilidad de estas bases de datos.

En segundo lugar, la coordinación entre las partes implicadas debe abarcar varias dimensiones. Los cambios rápidos de la demanda de determinadas ocupaciones en las redes sociales son tan relevantes como las tendencias más lentas pero precisas del empleo en escalas geográficas variables. Una exploración inicial de la información sobre Barcelona contenida en el Banc Integrat de Dades elaborado por el Consell General de Cambres de Catalunya ha demostrado que una formación profesional integrada debe tener en cuenta las desigualdades. Una conclusión clave de AIVET es que las desigualdades son significativas no solo entre tipos de programas (por ejemplo, los que llevan a cabo los sistemas escolares y los servicios públicos de empleo), sino también dentro del mismo tipo de programas, como se ha visto en Barcelona con las brechas relacionadas con el entorno socioeconómico, el género, la edad y la nacionalidad. Una herramienta de IA que verifique la solidez y la exactitud de los análisis estadísticos realizados en diferentes bases de datos locales puede fortalecer el potencial de estas fuentes para ofrecer información sólida sobre el mercado laboral y las competencias de los graduados en formación profesional.

Resum executiu

El projecte AIVET examinarà diferents tipus d'informació que poden recolzar el disseny dels programes d'educació i formació professional (FP). El projecte se centra en tres ciutats europees. Barcelona s'ha convertit en una destinació turística molt coneguda en les últimes dècades i també ha desenvolupat clústers d'informació i biotecnologia. Viena és una ciutat global durant més d'un segle. Sofia és l'economia regional més dinàmica de Bulgària. Aquests tres casos probablement revelaran reptes i oportunitats comuns per emmarcar l'FP en un context urbà determinat.

La revisió segueix el bucle que uneix els sistemes i les competències d'FP i la informació sobre el mercat laboral. La idea és que el primer contribueixi a configurar el segon mentre que el segon és necessari per avaluar els programes del primer. L'ideal seria que les reformes resultin d'avaluacions que es basen en aquesta informació. Però les connexions en ambdues direccions es basen finalment en conjunts de relacions socials entre estudiants, professors, tècnics dels serveis d'ocupació, responsables polítics i empresaris. Els sistemes d'FP són els resultats institucionals de conjunts molt complexos de relacions entre aquests actors socials. El projecte se centrarà en els conjunts de relacions que intervenen en el mesurament i en la configuració dels itineraris dels alumnes.

La revisió respon parcialment a dos conjunts de preguntes de recerca.

Un primer conjunt té a veure amb la mesura. Quines mesures produeixen les operacions reals dels sistemes d'FP? Com utilitzen aquestes mesures els actors socials implicats? La revisió de la literatura acadèmica, les revisions de la literatura grisa i les descripcions de les bases de dades donen resposta a la primera pregunta i cobreixen parcialment la segona.

∉ Els experts han desenvolupat sistemes d'informació per a la FP que s'orienten a estudiants individuals que han de prendre una decisió (p. ex., utilitzant dades de xarxes socials professionals) o bé informen els responsables de les decisions sobre les condicions actuals dels sistemes d'FP i dels mercats laborals (p. ex., utilitzant registres i enquestes oficials). Mentre que el primer tipus proporciona informació oportuna, el segon ofereix mesures més fiables del mercat de treball.

∉ A Barcelona, Sofia i Viena, la governança dels sistemes d'FP opera cada cop més a nivell local. A les tres ciutats, les parts interessades del sistema

d'FP necessiten com més va millors sistemes d'informació per recolzar la planificació estratègica. Tot i que la xarxa de grups d'interès és més gran i densa a Viena, les xarxes corresponents de Barcelona i Sofia s'estan estenent i cada cop són més actives. Es preveu que les reformes legals en curs ampliïn els aprenentatges i facilitin el reconeixement dels coneixements previs a Bulgària i Espanya. Malgrat la tradició ben establerta de planificació a Àustria, fins i tot Viena necessita elaborar les seves pròpies eines perquè el mercat laboral i la composició demogràfica de la ciutat difereixen de tot el país.

∉ Segons la descripció de les bases de dades de les tres ciutats, les dades disponibles, els informes de seguiment i les publicacions només recullen parcialment les dimensions clau del model elaborat pel CEDEFOP (2024). A nivell local, mentre que la informació sobre les tendències de l'ocupació i els llocs de treball futurs està disponible, és molt complicat copsar les habilitats i l'aprenentatge, la digitalització i les tendències del lloc de treball. Els anuncis de feina en línia proporcionen una altra font d'informació local, que distingeix les habilitats i l'aprenentatge. Tanmateix, l'informe difícilment pot concloure que aquesta informació cobreix un tema tan indispensable com és l'articulació dels programes d'FP amb les necessitats dels empresaris.

El balanç del primer conjunt de preguntes reclama una reflexió. Sens dubte, el CEDEFOP ha esbossat un esquema rellevant i moltes autoritats i parts interessades estan recopilant informació rellevant. Tanmateix, les mesures disponibles no estan clarament arrelades en convencions significatives que realment ajudin els proveïdors, estudiants i reguladors d'FP a realitzar les seves tasques.

La segona pregunta de recerca aprofundeix en els itineraris dels estudiants. D'on venen? On van? Fins a quin punt són agents actius de la seva via?

El següent llistat de troballes resumeix els principals resultats de l'anàlisi estadística del Banc Integrat de Dades, proporcionada pel Consell de Cambres de Comerç de Catalunya:

- Els estudiants que només han acabat l'educació secundària obligatòria (XCINE2) i els estudiants amb una formació acadèmica superior (p. ex., CINE3) trien diferents programes de FP.
- Els factors d'accés als cCicles Formatius de Grau Mitjà (CFGM) o als Cicles Formatius de Grau Superior (CFGS) han variat en els darrers anys.

- El nivell socioeconòmic del barri sembla que contribueix molt a la matriculació en escoles privades.

- Els i les estudiants majors de l'edat teòrica de cada curs es matriculen de manera diferent als CFGMs i els CFGSs en funció de les famílies professionals.

- Diferents estudiants fan pràctiques en el sector públic, privat i el tercer sector econòmic. En general, l'alumnat de les escoles públiques i les dones tenen més probabilitats d'aconseguir experiència professional en el sector públic. Tanmateix, les famílies professionals també tenen un paper important.

- Els graduats en FP no tenen les mateixes oportunitats de trobar feina de qualitat. Les persones de classe mitjana i els homes tenen avantatge en comparació amb la resta. Tot i que certes famílies professionals redueixen aquesta bretxa, no contraresten l'efecte general.

- La probabilitat de trobar una feina relacionada amb l'especialitat de l'estudiant varia segons les línies sociodemogràfiques. Un resultat remarcable és que el gènere no influeix en aquesta variable. En canvi, la rellevància dels estudis per a la feina és molt menor entre les persones que viuen en barris de baixos ingressos, fan pràctiques en el sector públic i en el tercer sector, superen l'edat teòrica del curs que estudien, provenen d'un país estranger i es gradúen en CFGMs. No obstant això, els àmbits sanitari i informàtic destaquen per afavorir la rellevància laboral.

L'informe de revisió estableix una línia de base per als paquets de treball posteriors del projecte AIVET, que dissenyarà una eina d'IA per enfortir els sistemes d'informació i triangularà les fonts d'informació sobre els mercats laborals dels graduats en FP. A més, l'informe ens ensenya dues lliçons interessants.

En primer lloc, com que els sistemes d'informació depenen dels acords de coordinació entre autoritats, empresaris, escoles i altres parts interessades de l'FP, diverses bases de dades locals recullen informació sobre estudiants i graduats a diferents ciutats. Una contribució important d'una eina d'IA pot ser avaluar la comparabilitat d'aquestes bases de dades.

En segon lloc, els sistemes d'informació exhaustius han de cobrir diverses dimensions. Els canvis ràpids de la demanda de determinades ocupacions a les xarxes socials són tan rellevants com les tendències més lentes però detallades de l'ocupació a escales geogràfiques variables. Una primera exploració per a l'Àrea Metropolitana de Barcelona del

Banc de Dades Integrat elaborat pel Consell General de Cambres de Catalunya ha demostrat que els sistemes d'informació han de tenir en compte les desigualtats per assolir una certa coherència. Una de les conclusions clau del projecte AIVET és que les desigualtats són significatives no només entre els tipus de programes (per exemple, els gestionats pels sistemes escolars i els serveis públics d'ocupació), sinó també dins del mateix tipus de programes, com es veu a Barcelona amb diferències relacionades amb l'entorn socioeconòmic, el gènere, l'edat i la nacionalitat. Una eina d'IA que verifiqui la robustesa i la correcció de les anàlisis estadístiques basades en diferents bases de dades locals pot reforçar el potencial d'aquestes fonts per oferir evidències sòlides sobre el mercat laboral, els coneixements i les oportunitats dels graduats en FP.

Samenvatting

AIVET zal onderzoek doen naar de verschillende soorten informatie die mogelijk ten grondslag liggen aan het ontwerp van beroepsonderwijs- en opleidingsprogramma's (VET). Het project richt zich op drie Europese steden. Barcelona is de afgelopen decennia een bekende toeristische bestemming geworden en heeft ook clusters van info- en biotechnologie ontwikkeld. Wenen is al meer dan een eeuw een wereldstad. Sofia behoort tot de meest dynamische regionale economie van Bulgarije. Deze drie cases zullen waarschijnlijk gemeenschappelijke uitdagingen en kansen onthullen om VET in een bepaalde stedelijke context te kaderen.

De review volgt de draad die VET-systemen en vaardigheden en arbeidsmarktintelligentie met elkaar verbindt. Het idee is dat de eerste bijdraagt aan de vormgeving van de laatste, terwijl de laatste nodig is om de programma's van de eerste te evalueren. Idealiter zouden de hervormingen het resultaat moeten zijn van de evaluaties die gebruikmaken van deze intelligentie. Maar de verbindingen in beide richtingen zijn uiteindelijk afhankelijk van sets van sociale relaties tussen studenten, docenten, arbeidsbemiddelaars, beleidsmakers en werkgevers. VET-systemen zijn de institutionele uitkomsten van zeer complexe sets van relaties tussen deze sociale actoren. Het project zal zich richten op de sets van relaties die betrokken zijn bij meting en configuratie van de leerweg van de studenten.

Het overzicht beantwoordt gedeeltelijk twee sets onderzoeksvragen.

Een eerste set heeft te maken met meten. Welke metingen leveren de daadwerkelijke operaties van VET-systemen op? Hoe gebruiken de betrokken maatschappelijke actoren deze metingen? De academische literatuurstudie, de grijze literatuurstudies en de beschrijvingen van de databases geven antwoorden op de eerste vraag en behandelen de tweede gedeeltelijk.

∉ Experts hebben informatiesystemen voor VET (IS-VET) ontwikkeld die zich richten op individuele studenten die een keuze moeten maken (bijvoorbeeld door gebruik te maken van gegevens uit professionele sociale media) of die besluitvormers informeren over de huidige omstandigheden van VET-systemen en arbeidsmarkten (bijvoorbeeld door gebruik te maken van officiële registers en enquêtes). Terwijl het eerste type

tijdige informatie biedt, levert het tweede betrouwbaardere metingen over de arbeidsmarkt op.

∉ In Barcelona, Sofia en Wenen wordt het bestuur van VET-systemen steeds meer op lokaal niveau uitgevoerd. In de drie steden hebben de belanghebbenden van het VET-systeem steeds meer IS-VET's nodig om strategische planning te ondersteunen. Hoewel het netwerk van belanghebbenden in Wenen groter en hechter is, breiden de overeenkomstige netwerken van Barcelona en Sofia zich uit en worden ze actiever. Verwacht wordt dat lopende wettelijke hervormingen het aantal stageplaatsen zullen vergroten en de erkenning van eerder verworven kennis in Bulgarije en Spanje zullen vergemakkelijken. Ondanks de gevestigde traditie van planning in Oostenrijk, moet zelfs Wenen zijn eigen tools verder uitwerken, omdat de arbeidsmarkt en de demografische samenstelling van de stad verschillen van het hele land.

∉ Volgens de beschrijving van de databases in de drie steden, leggen de beschikbare gegevens, monitoringrapporten en publicaties slechts gedeeltelijk de belangrijkste dimensies van het CEDEFOP (2024)-model vast. Op lokaal niveau zijn weliswaar inlichtingen over trends in werkgelegenheid en toekomstige banen beschikbaar, maar vaardigheden en leren, digitalisering en trends op de werkvloer blijven ongrijpbaar. Online vacatures bieden ook een bron van lokale informatie, dat licht werpt op vaardigheden en leren. Het rapport kan echter nauwelijks concluderen dat deze informatie een onmisbaar thema als de verwoording van VET-programma's met de behoeften van werkgevers bestrijkt.

De stand van zaken met betrekking tot de eerste reeks vragen leidt tot een oproep tot reflectie. CEDEFOP heeft het concept van 'skills intelligence' in kaart gebracht en veel autoriteiten en belanghebbenden verzamelen relevante informatie. De beschikbare maatregelen zijn echter niet duidelijk geworteld in zinvolle afspraken die de aanbieders, studenten en toezichthouders van het VET echt helpen hun taken uit te voeren.

De tweede onderzoeksvraag gaat in op de leerweg van studenten. Waar komen ze vandaan? Waar gaan ze naartoe? In hoeverre zijn ze actieve agenten van hun traject?

De volgende lijst met bevindingen vat de belangrijkste resultaten van de statistische analyse van de Geïntegreerde Databank, verstrekt door de Catalaanse Raad van Kamers van Koophandel samen:

- Leerlingen die alleen het lager secundair onderwijs (ISCED2) hebben afgerond en leerlingen met een hogere academische achtergrond (bijv. ISCED3) kiezen voor andere IVET-programma's tijdens de bovenbouw van het voortgezet onderwijs.

- De factoren die toegang verlenen tot IVET-opleidingen op voortgezet onderwijs of HVET-opleidingen op tertiair niveau zijn de afgelopen jaren veranderd.

- Het sociaaleconomische niveau van de buurt lijkt een grote bijdrage te leveren aan de inschrijving voor privéscholen.

- De patronen van overjarige inschrijvingen zijn complex en variabel in IVET- en HVET-programma's, afhankelijk van de specialisatie.

- Verschillende studenten doen stages in de publieke, private en tertiaire economische sectoren. Over het algemeen hebben studenten van openbare scholen en vrouwelijke studenten meer kans om professionele ervaring op te doen in de publieke sector. Echter, specialisatie of beroepsfamilies spelen ook een belangrijke rol.

- VET-afgestudeerden hebben niet dezelfde kansen om hoogwaardige banen te vinden, aangezien studenten uit de middenklasse en mannelijke studenten een voordeel hebben ten opzichte van de anderen. Hoewel specialisatie van de beroepsrichting deze kloof verkleind, compenseert deze variabele niet het algemene effect.

- De kans om een baan te vinden die gerelateerd is aan de specialisatie van de student varieert volgens sociaal-demografische lijnen. Een opmerkelijk resultaat is dat geslacht deze variabele niet beïnvloedt. Daarentegen is beroepsrelevantie veel lager voor mensen die in buurten met een laag inkomen wonen, stages lopen in de publieke en derde sector, ouder zijn, uit het buitenland komen en afstuderen aan IVET-opleidingen op de middelbare school. De gezondheids- en IT-sectoren vallen echter op door de voorkeur te geven aan baan relevantie.

Het reviewrapport vormt de basis voor de daaropvolgende werkgroepen van het project AIVET, dat een AI-tool zal ontwerpen die IS-VET's versterkt en informatiebronnen over de arbeidsmarkten van VET-afgestudeerden trianguleert. Daarnaast levert het rapport twee interessante lessen op.

Ten eerste, aangezien IS-VET's afhankelijk zijn van coördinatieregelingen tussen autoriteiten, werkgevers, scholen en andere belanghebbenden van VET, verzamelen verschillende lokale databases informatie over studenten en afgestudeerden in verschillende steden. Een belangrijke bijdrage van een AI-tool kan zijn om de vergelijkbaarheid van deze databases te beoordelen.

Ten tweede moet de omvatting van IS-VET's meerdere dimensies bestrijken. Snelle veranderingen in de vraag naar bepaalde beroepen in sociale media zijn net zo relevant als tragere maar fijnmazige trends van werkgelegenheid op verschillende geografische schalen. Een eerste verkenning van de Integrated Databank die is opgesteld door de Catalaanse Raad van Kamers van Koophandel in Barcelona heeft aangetoond dat consistente IS-VET's rekening moeten houden met ongelijkheden. Een belangrijke conclusie van AIVET is dat ongelijkheden niet alleen significant zijn tussen de typen programma's (bijvoorbeeld die worden uitgevoerd door schoolsystemen en openbare arbeidsbemiddelingsdiensten), maar ook binnen hetzelfde type programma's, zoals te zien is in Barcelona met onderscheid gerelateerd aan de sociaaleconomische achtergrond, geslacht, leeftijd en nationaliteit. Een AI-tool die de robuustheid en correctheid van statistische analyses die worden uitgevoerd in verschillende lokale databases verifieert, kan het potentieel van deze bronnen versterken om gedegen arbeidsmarkt- en vaardighedeninformatie te leveren over de kansen van afgestudeerden in het beroepsonderwijs.

Zusammenfassung

AIVET wird verschiedene Arten von Informationen untersuchen, die möglicherweise als Grundlage für die Gestaltung von Berufsbildungsprogrammen dienen können. Das Projekt konzentriert sich auf drei europäische Städte. Barcelona ist in den letzten Jahrzehnten zu einem bekannten Tourist*innenenziel geworden und hat auch Cluster für Informations- und Biotechnologie entwickelt. Wien ist seit mehr als einem Jahrhundert eine Weltstadt. Sofia ist die dynamischste Wirtschaftsregion in Bulgarien. Diese drei Fälle werden wahrscheinlich gemeinsame Herausforderungen und Chancen aufzeigen, um die Berufsbildung in einem bestimmten städtischen Kontext zu gestalten.

Die Untersuchung verfolgt den Zusammenhang zwischen Berufsbildungssystemen und Fähigkeiten sowie Arbeitsmarktinformationen. Die Idee ist, dass Erstere zur Gestaltung Letzterer beitragen, während Letztere zur Bewertung der Programme der Ersteren erforderlich sind. Im Idealfall sollten Reformen das Ergebnis von Bewertungen sein, die auf diesen Informationen basieren. Doch die Verbindungen in beide Richtungen beruhen letztlich auf sozialen Beziehungen zwischen Schüler*innen, Lehrer*innen, Arbeitsvermittler*innen, politischen Entscheidungsträger*innen und Arbeitgeber*innen. Berufsbildungssysteme sind das institutionelle Ergebnis sehr komplexer Beziehungen zwischen diesen sozialen Akteur*innen. Das Projekt konzentriert sich auf die Beziehungen, die bei der Messung und Gestaltung der Ausbildungswege der Schüler*innen eine Rolle spielen.

Die Untersuchung beantwortet in Teilen zwei Gruppen an Forschungsfragen.

Ein erster Teil beschäftigt sich mit der Messung. Welche Messungen werden durch die tatsächliche Funktionsweise von Berufsbildungssystemen durchgeführt? Wie nutzen die beteiligten sozialen Akteur*innen diese Messungen? Die Analyse der akademischen Literatur, die Analysen der grauen Literatur und die Beschreibungen der Datenbanken liefern Antworten auf die erste Frage und decken teilweise auch die zweite ab.

∉ Expert*innen haben Informationssysteme für die Berufsbildung (IS-VETs) entwickelt, die sich entweder an einzelne Studierende richten, die eine Entscheidung treffen müssen (z. B. unter Verwendung von Daten aus professionellen sozialen Medien) oder Entscheidungsträger über den aktuellen Zustand der Berufsbildungssysteme und Arbeitsmärkte informieren (z. B. unter Verwendung offizieller Register und Umfragen).

Während der erste Typ aktuelle Informationen liefert, liefert der zweite Typ zuverlässigere Kennzahlen zum Arbeitsmarkt.

∉ In Barcelona, Sofia und Wien erfolgt die Steuerung der Berufsbildungssysteme zunehmend auf lokaler Ebene. In den drei Städten benötigen die Akteur*innen des Berufsbildungssystems zunehmend IS-VETs, um die strategische Planung zu untermauern. Obwohl das Netzwerk der Akteur*innen in Wien größer und dichter ist, breiten sich die entsprechenden Netzwerke in Barcelona und Sofia aus und werden aktiver. Laufende Gesetzesreformen dürften die Lehrlingsausbildung ausweiten und die Anerkennung früherer Lernergebnisse in Bulgarien und Spanien erleichtern. Trotz der gut etablierten Planungstradition in Österreich muss selbst Wien seine eigenen Instrumente ausarbeiten, da sich der Arbeitsmarkt und die demografische Zusammensetzung der Stadt von denen im Rest des Landes unterscheiden.

∉ Laut der Beschreibung der Datenbanken in den drei Städten erfassen die verfügbaren Daten, Beobachtungsberichte und Veröffentlichungen die wichtigsten Dimensionen des CEDEFOP-Modells (2024) nur teilweise. Auf lokaler Ebene sind zwar Informationen zu Beschäftigungstrends und zukünftigen Arbeitsplätzen verfügbar, aber Kompetenzen und Lernen, Digitalisierung und Arbeitsplatztrends bleiben schwer fassbar. Online-Stellenanzeigen sind ebenfalls eine Quelle lokaler Informationen, die Aufschluss über Kompetenzen und Lernen geben. Der Bericht kann jedoch kaum zu dem Schluss kommen, dass diese Informationen ein so unverzichtbares Thema wie die Abstimmung von Berufsbildungsprogrammen mit den Bedürfnissen der Arbeitgeber*innen abdecken.

Der aktuelle Stand in Bezug auf den ersten Fragenkomplex gibt Anlass zum Nachdenken. Zwar hat CEDEFOP das Konzept der Skills Intelligence ausgearbeitet, und viele Behörden und Interessenvertreter*innen sammeln relevante Informationen. Die verfügbaren Maßnahmen basieren jedoch nicht eindeutig auf greifbaren Konventionen, die den Anbieter*innen, Studierenden und Regulierungsbehörden der Berufsbildung bei der Erfüllung ihrer Aufgaben wirklich helfen.

Die zweite Forschungsfrage befasst sich mit den Lebenswegen der Studierenden. Woher kommen sie? Wohin gehen sie? Inwieweit sind sie aktive Gestalter ihres Lebensweges?

Die folgende Ergebnisliste fasst die wichtigsten Ergebnisse der statistischen Analyse der Integrierten Datenbank des katalanischen Rates der Handelskammern zusammen:

- Schüler*innen, die nur die untere Sekundarstufe (ISCED 2) abgeschlossen haben, und Schüler mit einem höheren akademischen Hintergrund (z. B. ISCED 3) wählen unterschiedliche schulische berufliche Erstausbildungsprogramme der Sekundarstufe II.

- Die Faktoren, die den Zugang zu beruflichen Erstausbildungen auf Sekundarstufe II oder zu beruflichen Erstausbildungsprogrammen auf Tertiärstufe ermöglichen, haben sich in den letzten Jahren verändert.

- Das sozioökonomische Niveau der Stadtteile scheint einen großen Einfluss auf die Einschreibungsrate in Privatschulen zu haben.

- Die Muster der Überalterung der Einschreibungen sind in IVET- und HVET-Programmen komplex und variieren je nach Fachrichtung.

- Verschiedene Studierende absolvieren Praktika im öffentlichen, privaten und dritten Wirtschaftssektor. Generell sammeln Schülerinnen und Schüler öffentlicher Schulen eher Berufserfahrung im öffentlichen Sektor. Allerdings spielen auch Spezialisierungen oder Berufsfamilien eine wichtige Rolle.

- Absolvent*innen einer Berufsausbildung haben nicht die gleichen Chancen, hochwertige Arbeitsplätze zu finden. Schüler*innen aus der Mittelschicht und Männer sind gegenüber den anderen im Vorteil. Obwohl die Spezialisierung der Berufsfamilien diese Lücke verringert, wirkt diese Variable dem allgemeinen Effekt nicht entgegen.

- Die Wahrscheinlichkeit, einen Job zu finden, der mit dem Fachgebiet der Student*innen zusammenhängt, variiert je nach soziodemografischem Aspekt. Ein bemerkenswertes Ergebnis ist, dass das Geschlecht diese Variable nicht beeinflusst. Im Gegensatz dazu ist die Jobrelevanz bei Personen, die in ärmeren Vierteln leben, Praktika im öffentlichen und dritten Sektor absolvieren, überaltert sind, aus dem Ausland kommen und Programme der beruflichen Erstausbildung auf Sekundarstufe II abgeschlossen haben, viel geringer. Die Bereiche Gesundheit und IT zeichnen sich jedoch durch eine höhere Jobrelevanz aus.

Der Bericht legt die Grundlage für die nachfolgenden Arbeitspakete des Projekts AIVET, in dessen Rahmen ein KI-Tool entwickelt wird, das IS-VETs stärkt und Informationsquellen über die Arbeitsmärkte von Berufsbildungsabsolventen trianguliert. Darüber hinaus liefert der Bericht zwei interessante Erkenntnisse.

Erstens: Da IS-VETs auf Koordinierungsvereinbarungen zwischen Behörden, Arbeitgebern, Schulen und anderen Akteuren der Berufsbildung beruhen, sammeln verschiedene lokale Datenbanken Informationen über Schüler*innen und Absolvent*innen in verschiedenen Städten. Ein wichtiger Beitrag eines KI-Tools könnte darin bestehen, die Vergleichbarkeit dieser Datenbanken zu beurteilen.

Zweitens müssen umfassende IS-VETs mehrere Dimensionen abdecken. Schnelle Veränderungen der Nachfrage nach bestimmten Berufen in sozialen Medien sind ebenso relevant wie langsamere, aber feinkörnige Beschäftigungstrends auf unterschiedlichen geografischen Skalen. Eine erste Untersuchung der vom katalanischen Rat der Handelskammern in Barcelona ausgearbeiteten Integrierten Datenbank hat gezeigt, dass konsistente IS-VETs Ungleichheiten berücksichtigen müssen. Eine wichtige Erkenntnis von AIVET ist, dass Ungleichheiten nicht nur zwischen Programmtypen (z. B. solchen, die von Schulsystemen und öffentlichen Arbeitsvermittlungsdiensten durchgeführt werden) von Bedeutung sind, sondern auch innerhalb desselben Programmtyps, wie in Barcelona bei Unterschieden in Bezug auf sozioökonomischen Hintergrund, Geschlecht, Alter und Nationalität zu sehen ist. Ein KI-Tool, das die Robustheit und Richtigkeit statistischer Analysen überprüft, die in verschiedenen lokalen Datenbanken durchgeführt werden, kann das Potenzial dieser Quellen stärken, solide Informationen über den Arbeitsmarkt und die Fähigkeiten von Berufsbildungsabsolventen zu liefern.

Résumé exécutif

Le projet AIVET examinera différents types d'informations susceptibles de soutenir la conception des programmes d'éducation et de formation professionnels (EFP). Le projet se concentre sur trois villes européennes. Barcelone est devenue une destination touristique réputée au cours des dernières décennies et a également développé des pôles d'info- et de biotechnologie. Vienne est une ville mondiale depuis plus d'un siècle. Sofia est l'économie régionale la plus dynamique de Bulgarie. Ces trois cas révéleront probablement des défis et des opportunités communs pour encadrer l'EFP dans un contexte urbain donné.

L'étude retrace la boucle qui relie les systèmes d'EFP et les informations sur les compétences et le marché du travail. L'idée est que les systèmes contribuent à façonner les informations tandis que les seconds sont nécessaires pour évaluer les programmes des premiers. Idéalement, les réformes devraient résulter d'évaluations qui s'appuient sur ces informations. Mais les liens dans les deux sens reposent en fin de compte sur des ensembles de relations sociales entre les étudiants, les enseignants, les agents de l'emploi, les décideurs politiques et les employeurs. Les systèmes d'EFP sont les résultats institutionnels d'ensembles très complexes de relations entre ces acteurs sociaux. Le projet se concentrera sur les ensembles de relations qui interviennent dans la mesure et dans la configuration des parcours des étudiants.

L'étude répond partiellement à deux séries de questions de recherche.

Un premier ensemble de questions concerne la mesure. Quelles mesures les opérations réelles des systèmes de formation professionnelle produisent-elles ? Comment les acteurs sociaux concernés utilisent-ils ces mesures ? La revue de la littérature académique, les revues de la littérature grise et les descriptions des bases de données apportent des réponses à la première question et couvrent partiellement la seconde.

∉ Les experts ont développé des systèmes d'information pour l'EFP (SIEFP) qui ciblent les étudiants individuels qui doivent faire un choix (par exemple, en utilisant des données provenant des médias sociaux professionnels) ou informent les décideurs sur les conditions actuelles des systèmes d'EFP et des marchés du travail (par exemple, en utilisant des registres et des enquêtes officiels). Alors que le premier type fournit des informations actualisées, le second fournit des mesures plus fiables du marché du travail.

∉ À Barcelone, Sofia et Vienne, la gouvernance des systèmes d'EFP se fait de plus en plus au niveau local. Dans ces trois villes, les acteurs du système d'EFP ont de plus en plus besoin des SI-EFP pour étayer la planification stratégique. Bien que le réseau des acteurs soit plus large et plus dense à Vienne, les réseaux correspondants de Barcelone et Sofia se développent et deviennent plus actifs. Les réformes juridiques en cours devraient élargir l'apprentissage et faciliter la reconnaissance des acquis en Bulgarie et en Espagne. Malgré la tradition bien établie de planification en Autriche, même Vienne doit élaborer ses propres outils car le marché du travail et la composition démographique de la ville diffèrent de ceux de l'ensemble du pays.

∉ Selon la description des bases de données des trois villes, les données disponibles, les rapports de suivi et les publications ne saisissent que partiellement les dimensions clés du modèle CEDEFOP (2024). Au niveau local, si des informations sur les tendances de l'emploi et les emplois futurs sont disponibles, les compétences et l'apprentissage, la numérisation et les tendances en matière d'emploi restent difficiles à cerner. Les offres d'emploi en ligne constituent également une source d'informations locales, qui mettent en lumière les compétences et l'apprentissage. Cependant, le rapport ne peut guère conclure que ces informations couvrent un thème aussi indispensable que l'articulation des programmes d'EFP avec les besoins des employeurs.

L'état de l'art concernant la première série de questions appelle à une réflexion. Certes, le CEDEFOP a défini le concept d'intelligence des compétences et de nombreuses autorités et parties prenantes collectent des informations pertinentes. Cependant, les mesures disponibles ne sont pas clairement ancrées dans des conventions significatives qui aident réellement les partenaires, les étudiants et les régulateurs de l'EFP à accomplir leurs tâches.

La deuxième question de recherche s'intéresse aux parcours des étudiants. D'où viennent-ils ? Où vont-ils ? Dans quelle mesure sont-ils des agents actifs de leur parcours ?

La liste suivante de résultats résume les principaux résultats de l'analyse statistique de la Banque de Données Intégrée, fournie par le Conseil des Chambres de Commerce de Catalogne :

• Les étudiants qui ont seulement terminé le premier cycle de l'enseignement secondaire (ISCED2) et les étudiants ayant une formation universitaire supérieure (par

exemple, ISCED3) choisissent différents programmes d'EFP basés sur l'enseignement secondaire supérieur.

- Les facteurs d'accès aux programmes d'EFP de niveau secondaire supérieur ou d'EFP de niveau tertiaire ont varié ces dernières années.

- Le niveau socio-économique du quartier semble contribuer grandement à la scolarisation dans les écoles privées.

- Les étudiants âgés de plus que l'âge théorique de chaque cours s'inscrivent différemment aux programmes de formation professionnelle de niveau secondaire supérieur ou tertiaire en fonction des spécialités professionnelles.

- Différents étudiants effectuent des stages dans les secteurs public et privé et l'économie sociale et solidaire. En général, ceux qui étudient dans les écoles publiques et les étudiantes ont plus de chances d'acquérir une expérience professionnelle dans le secteur public. Cependant, les spécialités professionnelles jouent également un rôle important.

- Les diplômés de l'EFP n'ont pas les mêmes chances de trouver un emploi de qualité, les étudiants de la classe moyenne et les étudiants de sexe masculin étant avantagés par rapport aux autres. Bien que les spécialités des familles professionnelles réduisent cet écart, cette variable ne contrecarre pas l'effet général.

- La probabilité de trouver un emploi en rapport avec la spécialité de l'étudiant varie selon les critères sociodémographiques. Il est remarquable de constater que le sexe n'influence pas cette variable. En revanche, la pertinence de l'emploi est beaucoup plus faible chez les personnes vivant dans des quartiers défavorisés, effectuant des stages dans le secteur public et le secteur tertiaire, ayant atteint l'âge adulte, venant d'un pays étranger et diplômées de programmes d'enseignement et de formation professionnelle initiale de deuxième cycle du secondaire. Toutefois, les domaines de la santé et de l'informatique se distinguent par une pertinence de l'emploi plus élevée.

Le rapport d'évaluation établit une base de référence pour les prochains lots de travaux du projet AIVET, qui viseront à concevoir un outil d'IA qui renforce les SIEFP et à trianguler les sources d'information sur les marchés du travail des diplômés de l'EFP. En outre, le rapport Le rapport met en lumière deux conclusions intéressantes.

Premièrement, comme les SIEFP reposent sur des accords de coordination entre les autorités, les employeurs, les écoles et les autres parties prenantes de l'EFP, diverses bases de données locales collectent des informations sur les étudiants et les diplômés dans

différentes villes. Une contribution importante d'un outil d'IA pourrait être d'évaluer la comparabilité de ces bases de données.

Deuxièmement, les formations professionnelles et d'enseignement supérieur doivent couvrir plusieurs dimensions. Les changements rapides de la demande pour certaines professions dans les médias sociaux sont aussi pertinents que les tendances plus lentes mais précises de l'emploi à des échelles géographiques variables. Une première exploration dans l'aire métropolitaine de Barcelone de la Banque de Données Intégrée élaborée par le Conseil Catalan des Chambres de Commerce a montré que des formations professionnelles et d'enseignement supérieur cohérentes doivent tenir compte des inégalités. L'un des principaux enseignements de l'AIVET est que les inégalités sont importantes non seulement entre les types de programmes (par exemple ceux gérés par les systèmes scolaires et les services publics de l'emploi), mais aussi au sein d'un même type de programmes, comme on l'a vu à Barcelone avec des clivages liés au contexte socio-économique, au sexe, à l'âge et à la nationalité. Un outil d'IA qui vérifie la robustesse et l'exactitude des analyses statistiques menées dans différentes bases de données locales pourrait renforcer le potentiel de ces sources à fournir des informations fiables sur le marché du travail et les compétences concernant les opportunités des diplômés de l'EFP.

Introduction

Between 2023 and 2026, AIVET is exploring the local capacity for skills and labour market intelligence in Barcelona, Sofia and Vienna. This report accounts for the initial work package, which involved reviewing grey and academic literature and analysing the database that the Council of the Catalan Chambers of Commerce has generated in Barcelona. Subsequent work packages will utilise artificial intelligence to develop a tool that enhances the quality of future local databases analyses. Additional packages will triangulate this information with qualitative data gathered by means of interviews and focus groups.

This report is an output of Work Package 2: Reviewing intelligence on VET local labour markets. As per the application approved by the Spanish Erasmus+ Agency (SEPIE) in 2023, this report aims to introduce the theme, review the academic and the grey literature, describe the available databases and conduct statistical analyses. These analyses will form the foundation for further work packages. The conclusions will forecast the potential comparability of the resulting intelligence.

The consortium and the associate partners gather universities and stakeholders of vocational education and training (VET) in the three cities. Additionally, a team of engineers based at the Free University of Brussels (VUB) will be in charge of the technical component. An associate partner from Brussels is also contributing. Thus, the participants are complementary in terms of academic disciplines and professional specialisation.

AIVET draws on the common expertise of the partners in a variety of previous projects. Remarkably, UAB, the University of Vienna (UNIVIE) and several external advisors have collaborated in Horizon 2020 YOUNG_ADULLLT (URL https://www.young-adulllt.eu/) and Horizon Europe CLEAR (https://clear-horizon.eu/), which examine lifelong and VET policies along with young people's life trajectories. UAB, the Free University of Brussels (VUB) and one of the external advisors have collaborated in Erasmus+ Employability in Programme Development (https://www.gla.ac.uk/research/az/epd/), which has piloted a similar AI tool to monitor the employability of higher education graduates.

The importance of local intelligence on VET labour markets

AIVET will examine different types of information that may potentially underpin the design of vocational education and training (VET) programmes. The project focuses on three European cities. Barcelona has become a well-known tourist destination in the last decades and has also developed clusters of info- and bio- technology. Vienna has been a global city for more than a century. Sofia is the most dynamic regional economy in Bulgaria. These three cases will likely reveal common challenges and opportunities to frame VET in a given urban context. This section will frame some research questions that might generate 'intelligence' from raw data and information.

According to UNESCO, the organisation of VET is sensitive to local contexts:

VET comprises education, training and skills development relating to a wide range of occupational fields, production, services and livelihoods. It is a part of lifelong learning (...) VET also includes a wide range of skills development opportunities attuned to national and local contexts (UNESCO, n.d.).

AIVET will map out the available information and the potential intelligence of the skills and labour market of VET graduates in three different cities located in Central, Southeastern and Southwestern Europe. These cases will showcase opportunities and challenges in a variety of "national and local contexts". The results will also suggest more elaborated questions about the geography of VET, such as issues related to mobility, socioeconomic disparities, social cohesion and innovation. But the local studies of VET do not yet provide more detailed criteria to rely on a fully- fledged geographical analysis.

Figure 1 sketches the loop that links VET systems and skills and labour market intelligence. The idea is that the former contributes to shaping the latter while the latter is necessary to evaluate the programmes of the former. Ideally, reforms should result from evaluations that draw on this intelligence.

Such a simple outline highlights the contribution of skills and labour market intelligence to the functioning of VET systems. These systems articulate programmes that deliver proper

education and training, as well as internships, career guidance, qualifications frameworks and validation of prior learning. At the same time, education and training programmes are often stratified. On the one hand, while some lead to a professional qualification, others prepare for further training but do not formally qualify graduates for a profession. On the other hand, even the education and training programmes that share the same institutional standing may differ according to the social origin of the students (Pilz, 2016).

The diagram also indicates that the connections in both directions eventually rely on sets of social relationships between students, teachers, employment officers, policy makers and employers. VET systems are the institutional outcomes of very complex sets of relationships between these social actors. The project will focus on the sets of relationships that are involved in measurement and the configuration of students' pathways.
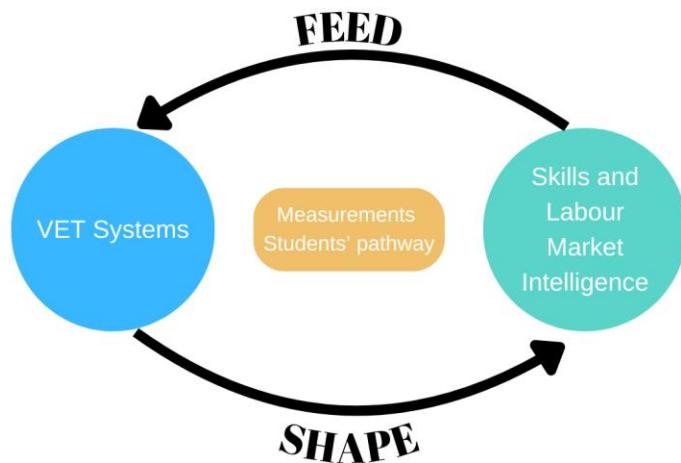
Figure 1 Intelligence loop of local VET systems

Figure 1 frames two research questions that will guide the whole AIVET project. The simple and ideal outline only sketches two arrows, which eventually portray an ideal method of policy design. But the whole figure strongly suggests that it is plausible to spell out the relationships that mediate the connections between institutional systems and the available intelligence about its outputs. The people involved in these relationships become the agents that constitute a given type of measurement. Although students are not

direct agents of measurement, the resulting information mostly focuses on their individual pathways between educational programmes as well as between education and employment.

A first set of research questions has to do with measurement. What measures do the actual operations of VET systems produce? How do the involved social actors use these measures?

A subsequent work package will pilot AI-driven labour market intelligence tools. The application of an artificial intelligence tool to the local databases on VET will help the researchers and engineers of the consortium compare the main indicators that different local VET systems generate through their routines. A Delphi poll will capture the perspective of the education and employment officers that normally use the resulting information to evaluate some aspects of the main VET programmes in each city.

CEDEFOP (2024) offers a curated selection of 'skills intelligence' indicators that covers the following themes:

- Employment trends (i.e., growth of employment per country and distribution per occupation)
- Digitalisation and technology (including automation risks by occupation)
- Future jobs (including projections of employment growth)
- Skills and learning (i.e., education and qualifications, online job advertisements, skills mismatch)
- Workplace trends (i.e., types of contracts)
- Skills in online job advertisements

The current report provides some initial answers by comparing the set of indicators adopted by CEDEFOP and the actual information contained in the local databases that are normally used in the three cities. Below, the section on local VET labour markets reaches a few partial conclusions on the grounds of this comparison. The report also includes bivariate and multivariate analyses of the Integrated Databank on which the Council of the Catalan Chambers of Commerce collects information about the internships of VET students in Catalonia.

These research questions are inspired by the main conclusions of the political economy of skills and the sociology of measurement. The former has distinguished Central European 'coordinated market economies' from Anglo-Saxon 'liberal market economies´. While governments and businesses are engaged in common social networks in which they exchange information and negotiate many issues in the coordinated economies, the relationships between government and business are basically mediated by stock markets, competence rules and quality standards in Anglo-Saxon countries. Recent findings of this literature notice that, in coordinated economies, governments are becoming orchestrators that attempt to engage businesses in a new type of associations that regulate labour markets (Busemeyer, Carstensen and Emmenegger, 2022; Graf, Staebel and Emmenegger, 2023). At first sight, labour market and skills intelligence seems to be one of these forms of orchestration.

According to the sociology of quantification, measurement normally entails comparisons that are proposed and interpreted by social agents who establish certain relationships between them (Desrosières, 2000; Mennicken and Espeland, 2019). Sociological analyses of measurement, then, must distinguish between the conventions that the partners adopt when deciding that a measure is reliable and the organisations in which these conventions are embedded.

Conventions are agreements that become social rules. These partners eventually agree on the value of an indicator and the heuristic value of certain analyses. VET systems are composed of organisations that design, implement and evaluate policies. These organisations need skills and labour market information to set statistical benchmarks and appraise their previous activities. Some of them have set up and curated the databases that generate such information.

CEDEFOP (2024) has invited the stakeholders of VET to consider the importance of 'labour market information' and 'skills intelligence'.

The second research question delves into the relationships that configure the pathways of students. Where do they come from? Where are they going? To what extent are they active agents of their pathway? To what extent are the human- resources policies of employers coordinated with the specialities and the preferences of the recent graduates?

In the report, the section on the Integrated Databank in Catalonia also proposes initial but partial answers to these questions. Further work packages will capture the views of students by means of interviews and the views of employers by means of focus groups.

These research questions are inspired by the literature on skills ecologies and the life course of individuals. Skills ecologies emerge from local configurations of firms and public services that create and diffuse collective knowledge (Finegold, 1999). Eventually, knowledge economies rely on innovations that often emerge from local concentrations of talent, technology, firms and investors (Castells, 1996; Florida and Mellander, 2018). The core of these local configurations are firms that simultaneously compete and cooperate in creating new products and services (Piore and Sabel, 1984). Governments greatly contribute to configuring these local innovation systems through education and training, urban development, transportation, active labour market policies and other related public policies (Lundvall, 2007).

Life course research has convincingly claimed that the biographical pathways of individuals are complex outcomes of their agency and the resources endowed by their unequal social positions. Institutional arrangements mediate the connections between social origins and destinations (Mayer, 2009). Thus, the likelihood of transition from upper secondary to tertiary education varies across countries (Blossfeld, Blossfeld and Blossfeld, 2016), and the risk of early leaving and exclusion from education, training and employment varies across regions (Rambla and Scandurra, 2021). An emerging strand of research is investigating the beliefs that lead students to choose their professions. Socio-economic status is likely to lower their expectations (Dräger and Wicht, 2021), and awareness of gender polarisation is widespread (Krueger, Ebner and Rohrbach-Schmidt, 2024). But previous evidence about the internal stratification of VET systems is still incomplete.

In a nutshell, the AIVET project will investigate to what extent VET systems take advantage of labour market and skills information. But the potential advantage is not automatic; rather, it is constructed in social fields where the main decision-makers measure the pathways of students. The report provides evidence on the measures that are used in Barcelona, Sofia and Vienna. It also portrays some aspects of the pathways of students in Catalonia. The whole array of literature reviews, database descriptions and multivariate analyses that result from this work will eventually become the inputs of the design of appropriate artificial intelligence tools that improve the production of intelligence from information about the employment of VET graduates.

Information systems about local VET labour markets

An emerging strand of scholarship investigates how information systems (IS) enhance the responsiveness of Vocational Education and Training (VET) to the evolving demands of the labour market. In this section, a literature review will assess evidence, distinguish types of IS and report on interventions aimed at systematising information about skills development.

This process will involve iterating on initial definitions and organizing relevant information to build a comprehensive understanding of the role of IS in fostering specific competencies. A significant aspect of this review will involve addressing secondary questions related to institutional settings, program design, and the involvement of external actors, particularly businesses and industry partners. These secondary questions will explore the degree to which IS are more effective in certain economic sectors or for specific job types, the impact of pre-established collaborations between VET institutions and businesses, and the importance of national or regional standards for IS integration. Additionally, the review will examine the role of labour market intelligence and employer engagement in enhancing the effectiveness of VET programs.

The literature review will suggest how digital infrastructure, government policies, and employer partnerships can contribute to the integration of IS in VET systems. Another focal point will be understanding how IS contributes to the development of curricula that are responsive to digitalization and the evolving needs of the labour market, with a particular emphasis on technical, digital, and soft skills that are critical for VET graduates.

Moreover, the literature review will explore the impact of IS on VET institutions, evaluating their role in improving overall institutional effectiveness, including the quality of training programs and the successful preparation of students for entry into the digital workforce. The integration of IS into VET programs will be assessed in terms of both immediate outcomes, such as curriculum improvement, and long-term outcomes, such as graduate employability and labour market integration.

The initial search for literature was performed on February 1st, 2024, to identify English-language articles about the uses of IS in upper- secondary and tertiary-level VET in Web of Science and Scopus between 2002 and 2024. The main Boolean keywords referred to IS (A), the labour market (B) and VET (C). Table 1 indicates that an initial large set of documents was

narrowed down by several filters (A AND B, A AND B AND C). The titles allowed for a first screening and the abstracts for a second one. The output was 17 papers.

This corpus is a well-rounded selection of academic works, composed primarily of journal articles and conference proceedings papers published between 2008 and 2023. The themes encompass theoretical discussions, empirical research, and applied studies. The citation counts detect a mix of established research with high academic impact (e.g. two papers have 11 and 16 citations). The most highly cited is "Balancing skills in the digital transformation era: The future of jobs and the role of higher education" which was published in 2022 and received 16 citations. Others are emerging works that are still gaining recognition.

Table 1 Articles included in the literature review

LIST A	21,302
A+B	87
A+B+C	3
ALL	87
First screening	23
Second screening	17

This review outlines the advantages and limitations of the application of IS to VET.

The use of information systems in Vocational Education and Training (VET) governance offers numerous benefits, particularly in enhancing competency alignment between education and labour market demands. System Professionals and OntoHR are instrumental in aligning training curricula with the dynamic needs of industries. These systems improve employment outcomes and resource utilization by enabling graduates to acquire skills that are directly relevant to their careers (Golinski et al., 2016; Kismihok et al., 2012; Goulart et al., 2022). Furthermore, competency models and job-matching systems, such as those described by Ghosh et al. (2020) and Bendler and Felderer (2023), provide students with actionable feedback, allowing them to identify and address skill gaps effectively.

Information systems also play a crucial role in career development by providing rating systems that enable educational institutions to link the professional

growth of educators to performance metrics. This approach optimizes resource allocation while fostering motivation and professional advancement (Makarenko et al., 2018). Furthermore, platforms that facilitate knowledge transfer and collaboration between educational institutions and industries enhance innovation and skill development. Ramirez and Dickenson (2010) highlight the importance of fostering such collaboration through knowledge brokering systems, while Wiedenhofer et al. (2017) and Soliz and Ecton (2023) emphasize the value of partnerships between educators and employers in improving program effectiveness.

The adoption of systems for skill tracking and matching further supports the employability of graduates by ensuring that they acquire competencies that are most valued by employers (Gatteschi et al., 2016; Soliz and Ecton, 2023). Moreover, information systems address regional disparities in labour market dynamics by enabling targeted interventions. These systems foster equity and improve resource distribution across diverse regions, thereby contributing to more inclusive labour market participation (Beluli, 2015).

Another significant advantage of information systems lies in their ability to provide detailed labour market insights. By analysing labour market demands, these systems facilitate the alignment of vocational training programs with industry requirements (Golinski et al., 2016; Beluli, 2015). Big data models further enhance decision-making processes by offering insights into employment trends, thereby enabling institutions to design programs that boost graduate employability (Wang, 2022; Gatteschi et al., 2016). The Vocational Guidance Management System (VGMS) represents another example of how such systems integrate vocational guidance with labour market data, streamlining both career counselling and job placement (Mahir et al., 2021).

While the benefits of integrating information systems into VET governance are evident, several challenges persist. One of the primary obstacles is the technological and infrastructural barriers associated with their implementation. Integrating advanced IT systems requires substantial investments in hardware, software, and training, which may not be uniformly accessible across all regions (Golinski et al., 2016; Beluli, 2015).

The complexity of integrating these systems into existing infrastructures poses additional challenges, as highlighted by Mahir et al. (2021) and Soliz and Ecton (2023). Rapid technological advancements also necessitate continuous updates, which can be resource-

intensive for institutions (Soliz and Ecton, 2023). Furthermore, limited financial and human resources exacerbate these challenges, particularly in recruiting qualified instructors and maintaining long-term collaborations with industry stakeholders.

Skill gaps among both educators and students further hinder the effective utilization of information systems. As noted by Makarenko et al. (2018) and Ramirez and Dickenson (2010), the lack of technical expertise among users significantly limits the impact of these systems. Additionally, the fast-paced evolution of job requirements poses challenges for VET systems in remaining relevant and up to date (Golinski et al., 2016; Beluli, 2015). Ensuring that training programs align with the dynamic needs of the labour market is a persistent issue, as outdated content reduces their effectiveness in addressing industry demands (Gatteschi et al., 2016; Soliz and Ecton, 2023).

Another critical challenge relates to data privacy and security. The management of large-scale datasets requires robust security measures to protect sensitive information about users and institutions (Makarenko et al., 2018). Institutions often lack the advanced skills necessary to handle and analyse these datasets effectively (Wang, 2022; Bendler and Felderer, 2023). Additionally, the growing reliance on information systems amplifies concerns regarding data privacy, making this an urgent issue for stakeholders (Bendler and Felderer, 2023).

Lastly, variations in regional economic development and labour market structures create disparities in the effectiveness of these systems. As Beluli (2015) highlights, addressing these inequities requires targeted interventions and policies to ensure that information systems serve all regions equitably.

The review identifies two primary types of information systems documented in the literature and utilised in VET governance. The first category includes systems that directly inform VET graduates about their opportunities. Golinski et al. (2016), Kismihok et al. (2012), and Goulart et al. (2022) describe systems that link training curricula with the job market. Ghosh et al. (2020) and Bendler and Felderer (2023) argue that competency models and job-matching systems provide students with actionable feedback, enabling them to effectively identify and address skill gaps. Mahir et al. (2021) observe that the Vocational Guidance Management System facilitates more effective career counseling and job placement, streamlining the transition of students into the workforce. Additionally, artificial

intelligence (AI) and big data models significantly enhance decision-making processes by analysing employment trends.

The second category includes systems that convey information to labor market analysts and decision-makers involved in education, training, and active labor market policies. Insights from competency models empower institutions to design programs that are responsive to labor market needs, thereby improving graduate employability (Wang, 2022; Gatteschi et al., 2016). The works of Ramirez and Dickenson (2010), Wiedenhofer et al. (2017), and Soliz and Ecton (2023) show that the effectiveness of programmes hinges on some sort of coordination between government, business and the civil society at different geographical scales. This second category showcases examples in which information systems build on the institutional capacity of local stakeholders.

While information systems offer transformative potential for VET governance and graduates, realising their full benefits necessitates overcoming significant challenges. Addressing technological barriers, skill gaps, dynamic market needs, and regional disparities will require concerted efforts from policymakers, educators, and industry stakeholders.

One of the significant barriers identified in the corpus of articles reviewed is the absence of a unified vocabulary. The field around VET, information systems and labour market prospects is transdisciplinary and it is not yet fully established, leading to inconsistencies in terminology. This issue manifests in the usage of terms that are often used to describe the same concept, or conversely, identical terms are employed to refer to distinct phenomena. Moreover, the absence of a cohesive framework or shared vision among stakeholders is a relevant shortcoming. Discussions often lack depth, failing to integrate into a unified understanding or problem formulation. This fragmented approach is mirrored in the academic literature, where knowledge remains dispersed across disciplines. Moreover, significant expertise resides within career service professionals, but much of this knowledge remains unpublished and inaccessible to the broader community. The lack of a consolidated philosophy or framework hinders the ability to tackle challenges comprehensively.

The absence of a common framework for discussing and addressing employability issues has direct implications for data governance. Currently, data sources are not harmonized, leading to inconsistent data collection practices across institutions, regions, and organizations. These discrepancies extend to granularity, data schemas, and semantic interpretations, with data often siloed within individual organizations. Such fragmentation

poses significant challenges to integrating data sources and leveraging them effectively to develop data-driven solutions.

The inherent complexity of the employability concept further exacerbates these challenges. Employability is influenced by numerous interacting factors, making it difficult to measure impact and generate quantifiable results. The task is further complicated by its interdisciplinary nature, which necessitates collaboration across fields with differing methodologies and terminologies. This interdisciplinary complexity often impedes mutual understanding and slows progress in developing effective solutions. Another barrier to addressing employability is the gap between academic and industry perspectives. While both sectors demonstrate significant interest in engaging with each other, they require time to adapt to one another's approaches and levels of abstraction. Industry often values pragmatic, actionable insights, whereas academia tends to operate at a higher level of theoretical abstraction. Bridging this gap is critical but requires sustained efforts to align priorities and establish a common ground for collaboration.

These challenges—ranging from the lack of shared vocabulary and frameworks to methodological complexity and gaps between academia and industry—underscore the multifaceted nature of employability as a field. Addressing these issues requires coordinated efforts to harmonize data governance, integrate knowledge across disciplines, and foster collaboration between stakeholders.

So far, experts have piloted two types of information systems for VET (IS-VETs). Individualised IS-VETs draw on professional social media to elaborate intelligence for the individual students who must make a choice. This type of IS-VETs delivers skills ontologies, rates companies and occupations, links employers' needs and VET curricula, and systematises career guidance. In contrast, policy- oriented IS-VETs use official registers and surveys to inform decision-makers of the current conditions of VET systems and labour markets.

These information systems illustrate the conventions and the organisation of measurement. Individualised IS-VETs deliver hands-on solutions for jobseekers and career counsellors, which capture the skills, learning and online job advertisement dimensions of the CEDEFOP's (2024) skills intelligence model. By collating several professional social media, these systems deliver timely intelligence of the trends that emerge from interactions between

professionals and firms in these digital environments. However, skills ontologies remain blind to employment trends, digitalisation, future jobs and workplace trends. Tech firms and some scholars are promoting these quick fixes, but the scope of the resulting intelligence is incomplete for these reasons.

Policy- oriented IS-VETs capture the local manifestation of the macro-trends that CEDEFOP (2024) highlight. Authorities are progressively equipped with well-grounded intelligence on the impacts of their policies. However, developing these systems is a time-consuming task which requires coordination between at least education and employment departments. Such coordination may be a challenge in several countries.

This section has also highlighted important shortcomings of the current versions of IS-VETs. Technical barriers and skills gaps should never be overlooked. AIVET aims at equipping VET and labour market analysts with better tools. Among others, these 'analysts' are teachers, headteachers, public employment services officers, human resources professionals, trade unionists, civil society representatives. If IS-VETs are to underpin democracy and social rights, it is indispensable that innovations eventually reach these professionals who are working in the front line of labour market and skills intelligence.

At the same time, IS-VETs can only create synergies within a common conceptual framework that so far is very vague according to the literature. Employability might become the common ground. But superficial understandings of the concept risk obscuring the diversity and complexity of the significant factors.

Local VET labour markets in Barcelona, Sofia and Vienna

Barcelona

In Barcelona, a network of stakeholders monitors the labour market of VET graduates. The Catalan VET Agency and the City Council of Barcelona have started to discuss strategic planning. A few pieces of research complement the information of official statistics. The local databases considered in this report have not been systematically exploited for research purposes.

The array of stakeholders includes chambers of commerce, public agencies, trade unions, business associations and the third sector.

The Council of Chambers of Commerce of Catalonia (*Consell de Cambres de Comerç de Catalunya*) has set up one of the main databases used by project AIVET, the Integrated Databank (qBID). Besides helping firms to manage international trade, the Chambers provide services to companies including core components of VET such as career guidance and internships. The Integrated Databank (qBID) collects the available registered data on VET internships in the whole of Catalonia.

In Barcelona, the Municipal Employment Service (*Barcelona Activa*) oversees active labour market policies in the city. The activity of the service in vocational training and prior learning validation feeds a database of students and courses, which is described in section 6 as the Barcelona Activa database (BAdata).

The Local Education Authority of Barcelona (*Consorci d'Educació de Barcelona*) is a consortium formed by the regional and municipal Departments of Education. It oversees primary and secondary education, including school-based VET programs in the city. Since 2015, the Department of Education has maintained a database that assigns a unique code (the RALC) to students at all school levels. Despite its potential for longitudinal studies, AIVET has not utilized the resulting data on family circumstances, schools, and graduation, mostly because VET internships and graduate jobs are not included.

Two bodies have initiated a conversation on strategic planning in Barcelona and Catalonia. The City Council sponsors the *Fundació Barcelona FP* (Barcelona VET Foundation), whose research department, the VET Observatory, has carried out foresight studies and surveyed the job market of graduates. Since its inception in 2015, the *Agència Pública de Formació I Qualificació Professionals de Catalunya* (Catalan VET Agency) aims at supporting the validation of prior learning, career guidance and the newly constituted VET hubs. It carries out foresight and evaluation research.

The employers' organisations participate in collective bargaining regularly. *Foment del Treball Nacional* (FTN) represents medium and big corporations, and *Petita i Mitjana Empresa de Catalunya* (PIMEC) voices the interests of small and medium enterprises. Trade Unions normally compete in the elections that are regularly held to choose the representatives of

workers in the councils that negotiate and implement collective agreements at the levels of firms, sections, Catalonia and Spain. The two bigger unions are *Comissions Obreres* (CCOO) and *Unió General de Treballadors* (UGT). FTN, PIMEC, CCOO and UGT normally participate in official conversations about VET such as the strategic deliberations of the Catalan VET Agency.

The *Taula del Tercer Sector Social de Catalunya* (Non-profits Coalition) gathers about three thousand non-profits that contribute to a variety of social services. Some of them deliver training to the most disadvantaged population, often with a focus on the youth. These non-profits are inspired on a wide array of ideologies, from Catholic religion (e.g., Caritas Diocesana) to more secular values (e.g., Fundació Ferrer I Guàrida)

Regarding strategic planning, the Catalan VET Agency publishes the Catalan VET Foresight Report, which monitors trends and sets benchmarks across various themes. The report identifies the supply of VET as comprising courses delivered by schools, the public employment system, and employers, along with the qualifications framework and recognition of prior learning. Demand is defined by enrolment in these VET courses and the number of applicants for recognition. By analysing data on course vacancies in schools and the public employment service, the report assesses the alignment between supply and demand. This set of indicators also tracks the number of graduates from school programmes and those who achieve accreditation through training courses and recognition activities led by the public employment service and employers. Additionally, the report provides foresight by examining key labour market trends, such as online job advertisements, newly contracted employees, the most in-demand occupations, hiring trends by VET branches, the fit between education and jobs, occupations with the highest vacancy rates, forecasts for skilled professionals, and job opportunities.

The Barcelona VET Foundation (2024) publishes two types of studies. So far, the Future Trends series has pondered the potential of VET specialities related to the circular economy, the electric vehicle sector, logistics, the port of the city, renewable energy and socio-sanitary services. It has also explored the implementation of protracted internships (dual VET) as well as the state of VET in other cities in the urban area. Recently, the Job Market Report has started to monitor employment data in the city.

The Organic Act 3/2022 on VET has not only updated regulations but also introduced an ambitious reform (Government of Spain, 2022). Its core idea is to integrate school-based programs with short-term vocational training and career guidance provided by public employment systems. To support this, a system of equivalences has been developed to recognize prior learning and facilitate further enrolment in suitable programmes. In a similar vein, the Law 3/2023 on Employment foresees responsible uses of information to train jobseekers and improve their employability (Government of Spain, 2023). AIVET might contribute to design the databases what will collect the resulting information in the future, but so far it cannot account for any database that gathers data on either transition from public employment services towards school-based programmes or skills development.

The European Commission has issued Country-Specific Recommendations during the last decade, some of which target VET. The 2024 Semester Cycle (June) compiles recommendations that encourage Spain to "step up policy efforts aimed at the provision and acquisition of the skills needed for the green transition" (Spain, 2023 CSR, 3.8), to focus on "skills development" (Spain, 2020 CSR, 2.3) and "access to digital learning" (Spain, 2020 CSR, 2.7). Additionally, the Commission expects Spain to "increase cooperation between education and businesses with a view to improving the provision of labour market relevant skills and qualifications, in particular for information and communication technologies (Spain, 2019 CSR, 2.10, 2.11). The Commission considers that the recent legal reforms have yielded limited progress towards these benchmarks.

A few studies have mostly monitored enrolment in school-based VET programmes in Barcelona and Catalonia. The main findings have noticed that increasing enrolment, gender segregation by specialities, a focus of career guidance on academic achievement and hardly any evidence on the match between VET and the job market.

- Regarding enrolment, Sánchez- Gelabert (2017) noticed a boost of enrolment in upper-secondary and tertiary level VET in the city between 2006 and 2016. The percentage of adult students had increased at the beginning but stalled and even diminished afterwards. In contrast, basic adult education programmes had progressively fewer students. The percentage of women had increased in these programmes. Termes (2020) concluded that VET school programmes did not cover the whole demand in the city while baccalaureate programmes did not fill all the vacancies.

- Termes (2020) also explored gender polarisation on VET school programmes. In essence, he reiterated previous findings on the high rate of female students in health, aesthetics and administrative branches, while male students prevailed in technology and industry. Some students breached these social norms, but the effects were asymmetric. While minority male students were privileged in the branches that were labelled as feminine, female students had to cope with strong prejudices in the branches that were considered masculine.

- Termes (2020) captured the very significant impact of career guidance at the end of compulsory education. Two biases were very significant. First, teachers normally encouraged well-performing graduates to enrol in the baccalaureate. Second, recommendations on VET branches often became self-fulfilling prophecies that were deeply rooted in gendered prejudices.

- The employability of graduates remains uncertain. Previous studies primarily focus on educational pathways. In the labour market, it is noteworthy that Mora et al (2021) observed an anticipated increase in demand for software developers with a VET qualification by 2030

Sofia

The following glossary describes the main stakeholders in the city.

- Ministry of Education and Science. The Ministry of Education and Science is the most critical stakeholder, coordinating educational policies nationally, including vocational education and training (VET). It has spearheaded initiatives like the DOMINO project and the Strategic Vision for Dual Vocational Education 2030, ensuring that VET systems meet labor market needs (Slavova, 2023a). The Ministry is responsible for overseeing the curriculum and guiding reforms to adapt to an evolving economy (Petkova, 2021).
- Consultative Council for Vocational Education and Training .This advisory council comprises representatives from the education sector, trade unions, and businesses. Its role is to ensure that the VET system is aligned with labor market demands, offering guidance on curriculum updates and reforms (Slavova, 2023b).

- Vocational High Schools and Professional Training Centres. Vocational high schools are key stakeholders in implementing dual education programs. These schools, such as STEM high schools and others focusing on technology and engineering, have made significant strides in curriculum innovation to meet the practical needs of the labour market (Petkova, 2021). Schools like the Professional High School of Electrical Engineering in Plovdiv and the National Vocational School of Precision Engineering and Optics in Sofia have played an instrumental role in modernizing education through industry partnerships (Slavova, 2023a).

- Employers and Business Associations. Businesses are pivotal stakeholders in the dual education system, providing the hands-on experience essential for VET students. Companies collaborate with vocational schools to create apprenticeship opportunities, thereby ensuring that students are industry-ready upon graduation (Slavova, 2023b). However, some businesses still regard VET as primarily the government's responsibility, which hampers full engagement in the system (Petkova, 2021). Additionally, businesses in regions like Plovdiv and Stara Zagora focus on manufacturing, while those in Burgas and Varna emphasize tourism. This regional alignment between industries and VET institutions plays a key role in ensuring that VET graduates have relevant job opportunities after completing their training (Slavova, 2023a).

- The Swiss-Bulgarian Cooperation Program has been a crucial player in introducing dual education to Bulgaria, notably through the DOMINO project. The program has provided financial support and resources, aiding the expansion and modernization of dual education (Slavova, 2023b).

- The Institute for Market Economics (Институт за пазарна икономика – ИПИ, IME) plays a vital role in assessing how well VET matches labor market needs. The IME's Index of Alignment Between Vocational Education and Economic Profile is a critical tool that evaluates the alignment between VET and regional economies, highlighting areas where VET needs improvement, particularly in sectors like ICT and manufacturing (Slavova, 2023b).

- Local Municipalities and Regional Administrations. Local municipalities collaborate with vocational schools to address specific regional labour market needs. Municipal governments often work closely with schools to create programs that reflect the demands of the local economy, ensuring that vocational students are prepared for relevant job opportunities (Petkova, 2021). For instance, Burgas has a strong focus on

tourism-related vocational programs, while Plovdiv emphasizes manufacturing and industrial education (Slavova, 2023a).

● Trade Unions and Labor Organizations. Unions represent workers' interests in the VET system and play a significant role in ensuring that vocational training aligns with fair labor practices. They participate in the Consultative Council for VET, advocating for improved conditions for both students and workers (Petkova, 2021).

● International Organizations (OECD and EU). International organizations like the OECD and the European Union provide valuable guidance on global best practices for vocational education. Reports from these organizations highlight the risks associated with inadequate VET systems, such as high youth unemployment rates and a lack of preparedness for technological advancements (Slavova, 2023a). These insights shape Bulgaria's approach to reforming its VET system to better align with global standards.

The Strategic Framework for the Development of Education, Training, and Learning in Bulgaria (2021-2030) sets the national agenda for improving vocational education and training (VET). One of the key objectives is ensuring that the VET system aligns with current and future labour market needs. It emphasizes the modernization of vocational qualifications, strengthening links between the education system and the economy, and enhancing the flexibility and attractiveness of VET to increase its appeal to learners (Cedefop, 2024)

The strategic goals align with the European Quality Assurance in Vocational Education and Training (EQAVET) framework, ensuring Bulgaria's adherence to European standards. In addition, the strategy encourages the development of green skills and digital competencies, reflecting the broader EU goals of sustainability and digital transformation (Cedefop, 2018)

In response to the COVID-19 pandemic, Bulgaria's National Recovery and Resilience Plan (NRRP) integrates VET reform as a key element of its economic recovery. The NRRP is aimed at addressing the mismatch between the skills provided by the educational system and those needed by the labor market. It includes substantial reforms aimed at updating the List of Vocational Education and Training Professions to reflect labor market demands (Amendments to the Vocational Education Act, 2024)

The plan includes the Reform of the Vocational Education Act, introducing changes such as updating the State Educational Standards and expanding access to e-learning and distance learning opportunities, particularly for adult learners. It focuses on protected

professions and occupations with labour market shortages, which helps target education in areas of high demand (Amendments to the Vocational Education Act, 2024).

Bulgaria's approach to VET also involves region-specific strategies to address local labor market needs. Sofia, for instance, has focused on developing programs in ICT and tourism, while Plovdiv has emphasized manufacturing and engineering, which are essential for its industrial base (AIVET, 2023). In cities like Plovdiv, local VET schools work closely with businesses in sectors like furniture manufacturing, a field that has successfully implemented dual education programs. This collaboration aims to prepare students for direct entry into the labor market through hands-on, real-world training (Dualnoto Obuchenie: Misija Nevozmozhna, 2023)

The dual education system, a central element of VET in Bulgaria, has seen significant reforms as part of the strategic planning efforts. The DOMINO project, which introduced the dual education model in partnership with Switzerland, continues to expand. It serves as a benchmark for new dual programs being rolled out across the country (Domino Project, 2023)

Several amendments have been introduced to ensure the sustainability and scalability of dual education. Teacher training for work-based learning is being improved, with new guidelines allowing for better collaboration between schools and companies. The accumulation and transfer of learning outcomes provide flexibility for learners to transfer qualifications across sectors, increasing mobility and employability (Amendments to the Vocational Education Act, 2024)

As part of the ongoing reform of the State List of Professions in Vocational Education and Training (SPPO), Bulgaria has proposed the establishment of Sectoral Councils for Skills. These councils aim to ensure that skills and training programs are better aligned with labour market needs. The councils will gather data on local labour market trends and coordinate with VET providers to ensure that curricula are updated regularly to reflect industry standards (Kak da Adaptirame Bulgarskata Sistema, 2020)

Bulgaria's strategy places a significant emphasis on lifelong learning, particularly as digitalization and automation increase the need for workers to update their skills regularly. The National Agency for Vocational Education and Training (NAVET) is tasked with validating non-formal and informal learning, helping individuals gain recognition for skills acquired outside

traditional educational pathways. This supports the inclusion of a broader segment of the workforce in the educational system, allowing them to stay competitive in a fast-changing labor market (Cedefop, 2024)

Bulgaria has received several Country-specific recommendations mentioning VET.

- 2023, CSR 3: Bulgaria needs to accelerate the development of skills and competences necessary for the green transition, particularly in the context of renewable energy and energy efficiency. This recommendation includes enhancing skills and education related to energy efficiency, social inclusion, and sustainable transport. The progress on these initiatives is reported as limited.

- 2023, CSR 3.8: The recommendation emphasizes the need to intensify policy efforts aimed at fostering skills and competences critical for the green transition. This is directly linked to VET and adult learning, focusing on aligning education with the green economy. However, progress remains limited.

- 2020, CSR 2: It highlights the need to strengthen active labor market policies and improve access to digital skills and equal education. VET plays a key role in this by equipping individuals with skills relevant for distance working and broader labor market participation. This also includes addressing gaps in minimum income schemes and ensuring social protection. Some progress has been made.

- 2020, CSR 2.4: The focus here is on promoting digital skills, reinforcing the role of VET in helping individuals transition into digitized labor markets. Limited progress has been observed in this area.

- 2019, CSR 4: The recommendation urges improvements in employability through skills enhancement, particularly digital skills and labor market-relevant education. Special emphasis is placed on improving education and VET for disadvantaged groups such as the Roma. Progress remains limited.

- 2019, CSR 4.1: It reiterates the need to reinforce skills, particularly digital skills, to enhance employability. Progress in this area remains limited.

- 2019, CSR 4.2: This focuses on improving the quality, inclusiveness, and labor market relevance of education and training, with special attention to Roma and other disadvantaged groups. It seeks to ensure non-discrimination and equal opportunities in VET. Progress remains limited.

Several publications have researched VET in Sofia.

One of the most prominent research projects based in Sofia is the DOMINO Project, a large-scale initiative aimed at integrating dual education into Bulgaria's VET system. This project, funded by the Bulgarian- Swiss Cooperation Programme, has been implemented in 32 vocational schools across 19 cities, including Sofia. DOMINO promotes a system where students split their time between classroom learning and practical workplace training. The project has shown significant success, particularly in fostering collaboration between businesses and vocational schools in Sofia. Nearly 61% of companies and 84% of schools involved in the project have reported a positive assessment of this partnership (Domino Project). A key outcome of the DOMINO project is the improvement of the dual education framework, providing students in Sofia with the opportunity to gain hands-on experience while still in school, preparing them for the labour market more effectively. Despite these achievements, the project also highlighted challenges, such as a lack of trust among companies that students would remain employed with them post-graduation, and gaps in the curriculum that do not fully meet modern business requirements (Domino Project).

Sofia has also been the focus of several green and sustainability-related research projects. One such project is the "Green Leadership for Hotel Managers" initiative, part of an Erasmus+ funded research. The project, implemented in partnership with Sofia-based organizations, aims to develop European competency standards in green leadership, particularly in the hospitality sector. The role of Sofia as a tourist destination makes this project particularly relevant, as it emphasizes sustainability in one of the city's largest economic sectors(National Education Agency).

Additionally, the GreenMICRED Pathways project, another Erasmus+ initiative, seeks to upskill and reskill low-skilled adults in green competencies, preparing them for careers in industries that are becoming increasingly focused on sustainability. The project is particularly relevant for Sofia, where environmental challenges and green economy trends are gaining attention (National Education Agency).

Sofia serves as a hub for academic discourse on vocational education through its participation in international conferences, such as the Education, Research & Development International Conference. This conference brings together educators and researchers from Sofia and beyond to discuss advancements in vocational education, lifelong learning, and the impact of digital transformation on education. The research presented at these conferences

contributes to Bulgaria's overall strategy for improving VET, with Sofia playing a key role in implementing new policies and initiatives (SciCon 2025).

Another significant area of research based in Sofia is the examination of gender and regional disparities in VET. Publications from Sofia-based academics, such as those by Ilieva-Trichkova, Stoilova, and Boyadjieva (????), have explored how gender differences impact participation in vocational education across different regions of Bulgaria, including Sofia. Their research, particularly on STEM fields and how these affect gendered career paths, has provided valuable insights into how vocational education can be more inclusive and better tailored to the needs of diverse student populations

Several government and EU-supported initiatives also focus on Sofia's VET landscape. For instance, the Balkan Work-Based Learning (WBL) Cooperation project, which began in 2023, is part of a larger Erasmus+ strategic partnership. This project seeks to promote work-based learning across the Balkans, with Sofia as one of the key cities for piloting innovative vocational education strategies

The Pilot Model for Tracking the Outcomes of Graduates from Vocational Education and Training presents a pilot model for tracking the outcomes of graduates from vocational education and training (VET) programs in Bulgaria, under a project funded by the Erasmus+ program. It outlines a methodology combining administrative data and surveys to monitor career development and higher education enrolment among 2018 VET graduates from three regions: Vratsa, Burgas, and Stara Zagora. Key findings highlight regional and gender disparities in professional qualification attainment, university enrolment, and employment outcomes. The project also evaluates employment sustainability and the speed of labour market entry, emphasizing the use of robust indicators and data protection measures. Recommendations aim to implement a national tracking system for VET graduates, enhancing data-informed policymaking. It is expected a similar report will be made for Sofia.

In 2024, Bulgaria's vocational education and training (VET) system experienced significant reforms, particularly aimed at addressing the skills mismatch in the labour market and enhancing the relevance of education for emerging sectors. Key updates include amendments to the Vocational Education and Training Act, which seek to modernize the list of professions taught in VET programs. This new list aligns more closely with the needs of the green and digital economies, adding professions such as robotics programming and

renewable energy technicians. Meanwhile, traditional trades like welding and locksmithing have seen a decline in student interest, reflecting a shift toward more technology-focused careers among the younger generation (Novinite)(БТА).

Additionally, the Bulgarian Ministry of Education adopted a 2030 Strategic Vision for dual training, emphasizing collaboration between businesses and educational institutions. The initiative seeks to increase the practical aspects of VET by expanding dual education programs, which combine in-class learning with hands-on experience in workplaces. This plan aims to better prepare students for future labour market demands, particularly in fields like green energy and information technology (БТА).

Moreover, the government introduced online vocational training for students over the age of 16, allowing greater flexibility and access to vocational education. This change is part of broader efforts to integrate digital technologies into the education system and make VET more accessible across regions (БТА). Overall, these reforms aim to ensure that Bulgaria's VET system responds effectively to both regional and national economic demands, focusing on sectors such as energy, technology, and hospitality (БТА)(БТА).

Vienna

In Austria, the key stakeholders of VET are the employment service and the coordination office. The main task of the national Public Employment Service (AMS) is "the implementation of the main labour market policy objectives of the Federal Minister of Labor and Social Affairs" as well as setting labour market policy emphases, bringing forth suggestions on how to design labour market policy, setting and enforcing quality standards for services provided, coordinating federally matched actions across its bodies, and its management board making sure that assigned tasks are performed orderly (Public Employment Service Law[1], §4 (2)). The social partners (Chamber of Commerce, Chamber of Labour, Industrial Association, and Trade Union Federation) are part of operations at every level and are central contributors to the designing of labour market policy.[2]

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[1] As of November 27, 2024;
https://www.ris.bka.gv.at/GeltendeFassung/Bundesnormen/10008905/AMSG%2c%20Fassung%20vom%2027.11.2024.pdf
[2] https://www.ams.at/organisation/ueber-ams/organisation

The Federal Coordination Office for Education/Training and Occupation (BundesKOST): BundesKOST is funded by the Federal Ministry of Social Affairs Service (SMS). The office accompanies processes and programs particularly pertaining to the Network for Vocational Assistance (Netzwerk Berufliche Assistenz; NEBA) – a network of programs promoted by the SMS to support people with disabilities and at risk of exclusion[3]. Additionally, it connects relevant stakeholders and promotes cooperation among them. It also informs through data analysis, reports, and events.

The key regional stakeholders are all represented as stakeholders in the Viennese Training Guarantee, which will be discussed in the section on strategic planning below. Since the network gathers many actors who are engaged in dense connections table 2 will give a brief overview.

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[3] https://www.neba.at/neba/was-ist-neba

Table 2 Stakeholders of the Viennese Training Guarantee (Wiener Ausbildungsgarantie)

Level	Stakeholder	General Function
Steering Group	Local Public Employment Service (AMS Vienna)	The regional branch of the AMS which performs the AMS' tasks at the level of Vienna as a region (Bundesland).
	Federal Ministry of Social Affairs Service (SMS)	The SMS aims to improve occupational and social participation of people with disabilities, health impairments and/or disadvantages. It coordinates connected programs to promote these groups, which are addressed both at employees and employers.[4]
	Vienna Employee Promotion Fund (waff)	waff supports and complements federal labour market policy in coordination with AMS and the social partners. It is an instrument of the City of Vienna to promote better occupational opportunities for employees in Vienna.[5]
	Vienna Social Fund (FSW)	FSW provides services to support care, people with disabilities, unhoused people, people with debt as well as the basic supply for refugees. It has around 170 partner organisations and serves around 145,000 customers a year.[6] It is also an instrument of the City of Vienna.
	Coordination Office for Youth, Education and Employment (KOST Wien)	KOST Wien is commissioned by the four stakeholders listed above who work together in a cooperation system intended at providing opportunities for formal education and training. The cooperation system's function is seen as creating a systematic and well-aligned support structure.[7] Its functions are similar to those of the BundesKOST in that KOST Wien is mainly in charge of coordinating and connecting stakeholders as well as analysing programs.[8]
Cooperation Partners	Vienna Directorate of Education	The Vienna Directorate of Education is responsible for all schools in Vienna and serves as contact for all of its students and teachers.[9]

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[4]
https://www.oesterreich.gv.at/themen/menschen_mit_behinderungen/rehabilitation/Seite.1170300.html

[5] https://www.waff.at/der-waff/mission-und-vision/

[6] https://www.fsw.at/p/das-unternehmen

[7] https://www.kost-wien-ausbildungberuf.at/auftraggeberinnen/

[8] https://www.kost-wien-ausbildungberuf.at/leistungen/

[9] https://www.bildung-wien.gv.at/ueber-uns/bildungsdirektion.html

	Municipal Department[10] (MA) 11: Children & Youth Welfare	MA 11 is in charge of strengthening youth rights and rights for children, with an added emphasis on prevention.[11]
	Municipal Department (MA) 13: Education & Youth	MA 13 is in charge of providing affordable education for all ages as well as leisure activities for children and youths. It funds, coordinates, and steers the supply of education and even runs some facilities itself.[12]
	Municipal Department (MA) 17: Integration & Diversity	MA 17 is in charge of informing and supporting immigrants as well as collecting data. It also promotes participation of immigrants and diversity in public offices.[13]
	Municipal Department (MA) 23: Economy, Labour & Statistics	MA 23 is in charge of fundamental matters of economic and labour market developments, collecting various statistical data and designing measures that promote scientific/innovation endeavours, among other tasks.[14]
	Municipal Department (MA) 40: Social Affairs, Social and Healthcare Law	MA 40 serves as a contact point for citizens with social and financial difficulties. It is in charge of approving and supervising social and healthcare facilities.[15]
	Chamber of Labour (AK), Vienna branch	The regional branch of the AK which performs the AK's tasks at the level of Vienna as a region (Bundesland). The Chamber of Labour sees itself as an institution that fights for workers and their rights. Per law, almost all employed workers are members of the AK. Every five years, members can vote to determine the political direction of the AK.[16]
	Austrian Trade Union Federation (ÖGB)	ÖGB is a non-partisan collective of unions which advocates for employed workers vis-à-vis the employers, the government and political parties. It has 1.2 million members.[17]

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[10] In Vienna, municipal departments are in charge of executing different functions.

[11] https://www.wien.gv.at/kontakte/ma11/aufgaben.html

[12] https://www.wien.gv.at/sozialinfo/content/de/10/InstitutionDetail.do?it_1=2099565

[13] https://www.wien.gv.at/kontakte/ma17/aufgaben.html

[14] https://www.wien.gv.at/advuew/internet/AdvPrSrv.asp?Layout=geschaeftseinteilung&Type=K&Hlayout=&STELLECD=2011121314530825

[15] https://www.wien.gv.at/kontakte/ma40/

[16] https://www.arbeiterkammer.at/ueberuns/akerklaertsich/deu/17-Antworten.html#heading_1__Wer_oder_was_ist_die_AK_

[17] https://www.oegb.at/der-oegb

	Industrial Association (IV), Vienna branch	The regional branch of the IV which performs the IV's tasks at the level of Vienna as a region (Bundesland). The IV serves as an independent representative of the Austrian Industry's interests. It advocates for industrial and industry-adjacent service employers vis-à-vis the government.[18]
	Chamber of Commerce (WKO), Vienna branch	The regional branch of the WKO which performs the WKO's tasks at the level of Vienna as a region (Bundesland). The WKO actively co-determines the economic framework in Austria and represent its members interest politically.[19] Its members are all business ventures that are subject to the Austrian trade regulations.[20]

The European Commission has issued Country-Specific Recommendations during the last decade, some also targeting VET. The 2024 Semester Cycle (June; European Commission, 2024) highlights Austria's specific challenges regarding its labour market situation. The European Commission (2024, p. 11) calls on Austria to "[b]oost the labour market participation of women" and to "[i]mprove labour market outcomes for disadvantaged groups, such as low-skilled job seekers and people with a migrant background, and raise the levels of basic skills, starting at school level". The Ausbildungspflichtgesetz (compulsory education and training law) was implemented in 2016 with the intention to promote "successful educational pathways and to avoid educational disadvantage as well as school dropouts as they arise" (Austrian Federal Ministry of Education, 2016, p. 2).

However, given the fact that young people (18-34) with lower education (ISCED 0-2) face drastically lower chances of labour market integration at an 59.2% employment rate in 2023 than people with medium (ISCED 3-4) at 85.6% and higher education (ISCED 5-8) at 90.0% (Eurostat, 2024a), one major challenge still lies in training persons with compulsory education for the labour market. Strategically, Austria further intends to tackle the challenges pointed out by the European Commission by "enforcing practical trainings"[21] which are seen as helping particularly persons who are less qualified (Austrian Federal Ministry of Labour and

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[18] https://www.iv.at/Die-IV/LS/Organisation/ueber-uns/ueber-uns.html
[19] https://www.wko.at/oe/wko/aufgaben-wko
[20] https://www.wko.at/oe/wko/wkg.pdf
[21] Practical trainings are those that are close to the workplace.

Economy, 2023, p. 16). To avoid labour shortage, the current national Labour Market Policy Targets foresee that young adults should be encouraged to seek company-based apprenticeships, and that they ought to be supported in these efforts (ibid.). This appears to be in line with Objective 1 (Resilience and excellence through quality, inclusive, and flexible VET) of the *Osnabrück Declaration on Vocational Education and Training* which stresses reinforcing "work-based learning" and strengthening "inclusive apprenticeships" (European Commission, 2020, p. 6).

The situation in Vienna differs from the national level in many ways. Economically, as a city region, its main focus lies on the tertiary economic sector (cf. KMU & L&R, 2023, p. 7). Its unemployment rate of 9.6% in 2023 is markedly higher than Austria's second-highest regional unemployment rate at 5.2% (Burgenland; Statistics Austria, 2024, p. 78). Demographically, its population is marked by a large share of people who are not Austrian citizens at 34.2% in 2023 (calculations based on City of Vienna, 2024). In terms of age, Vienna's population is the youngest on a regional level in Austria at a median age of 39.7 in 2023 (Eurostat, 2024b). Regarding the schooling system, Vienna lacks space and teachers as well as adequate supply of training positions, and its schools face challenges that come with migration mental health issues among students (waff, 2024, p. 11).

These differences, among others, necessarily require strategic planning that deviates – at least in some respects – from the national strategy. Vienna's most recent central strategic plan regarding qualifications – and thus VET – is called "*Qualifikationsplan Wien 2030*" (QUP; Qualification Plan Vienna 2030; waff, 2018). Its current rendition presents a work program for 2024 to 2026 (waff, 2024). The QUP is structured in areas of action with corresponding strategic and steering goals as well as indicators to monitor success, which are all guided by a set of general principles. The area of action most relevant to this report is the one on "school and initial vocational training". Its main goal is to increase educational attainment beyond compulsory education (waff, 2018, p. 13).

The intended ways in which this goal is steered revolve around (ibid.):
- teaching competences in compulsory education that help transitioning into further education or training
- young adults being supported in fulfilling their compulsory schooling and training until the age of 18
- if necessary, young adults being provided with preparatory training

- young adults with relevant requirements being closely supported in finding on-the-job training/apprenticeships within and beyond Vienna
- young adults who cannot find within-company apprenticeships being provided with supra-company apprenticeship opportunities
- Young immigrants being integrated into the educational and training system
- Increasing the share of people taking the final apprenticeship exam, the share of people passing said exam, and the share of people graduating from upper secondary schools

As of 2024, these goals are pursued through multiple projects focused on career guidance and promoting opportunities for migrants and disabled young adults, expanding school capacities at Viennese compulsory schools as well as colleges for higher technical vocational education where the goal is to promote better chances for participation of girls (waff, 2024, pp. 14-17). Current programs to reach the goals set in the city's 2030 agenda are subsumed under the so-called "Wiener Ausbildungsgarantie" (Viennese Training Guarantee; ibid., p. 18). This guarantee was established in 2010 to expand the supply of educational opportunities in Vienna (see Hofer, 2017, p. 3) and particularly targets early school leavers, young adults neither in education, employment, nor training (NEET), and early dropouts from training (Peczar & Tsohohey, 2023, p. 5). Its main pillars are school, counselling at schools, out-of-school education, general counselling and accompanying support, apprenticeships and vocational training, socio-economic companies, as well as the pillar of "Orientation / Pre-Accession / Post-Maturation" (see ibid., p. 7). Arguably one of the most crucial programs in Vienna are supra-company apprenticeships which are seen as "as indispensable pillars of the training guarantee" because the supply of apprenticeship companies that train young adults in Vienna is insufficient (waff, 2024, p. 19, translated NP).

This mismatch between supply of available within-company apprenticeship positions and young adults seeking such a position is particularly prevalent in Vienna. While there were around 70 aspiring apprentices for every 100 open within-company apprenticeship positions in Austria in 2023 (ratio of 0.7), Vienna had 350 aspiring apprentices for every 100 open within-company apprenticeship positions (ratio of 3.5; AMS, 2024, p. 4). Every other Austrian region has a surplus of supply over demand (ibid.). Across Austria, the occupational areas with the biggest mismatch ratios were observed for pharmaceutical commercial assistants (a ratio of 12.6 seeking per open position), IT (4.7 ratio), automotive technicians (2.6 ratio), and office clerks (2.3 ratio; ibid.). On the other side, other occupational apprenticeships had more supply than demand, such as cooks (0.2 ratio) or retail salespersons (0.4 ratio; ibid.).

Some publications have researched apprenticeships in Austria and Vienna. The *Lehre statt Leere* (VET instead of Void) programme aims at easing students' transition from compulsory education to apprenticeship training – mainly, through 'coaching' (see Document 39). The goal is to coach both apprenticeship providers and trainees (ibid.). The most recent annual report from 2022 (Document 42) records 2,145 trainees who benefited from coaching (+53.3% from 2021), of which 42.8% were female and 56.8% were male. At the same time, 323 institutions providing coaching services (+90.0% from 2021) were utilized (ibid., p. 1). The main topics for trainees were theory, learning difficulties, and psychological matters, the main topics for providers were lacking trainees, trainee-trainer conflicts, and seeking council on trainee coaching (ibid.). The least effective region in retaining trainees was Vienna (27%; ibid., p. 10).

According to the most recent data, in 2020 16,4% trainees dropped out of apprenticeships. Since the rates were 16% in 2010, 18.6% in 2018 and 19.7% in 2018, the trend seems to have improved after an uptick in the last decade (Document 43, p. 74). Most dropouts happened in supra-company apprenticeship training (35.6%) and tourism and leisure (22.9%) (ibid., p. 75) programmes. Supra-company training (*Überbetriebliche Ausbildung, ÜBA*) institutions offer young people the opportunity to complete an apprenticeship and obtain a recognised final certification without an in-company apprenticeship position (Document 63; Document 64). The latter was likely also a matter of declining tourism during COVID-19. Women were slightly more likely to drop out than men and non-Austrian citizens were twice as likely to drop out than Austrian citizens (Document 43, p. 76). Regionally, Vienna had the highest dropout rate at 19.4%, and Burgenland had the lowest at 10.4% (ibid., p. 77). The earlier training phases bear the highest risk of dropping out – 39.2% drop out within the first three months and 27.8% drop out between the first 3 and 12 months (ibid., 78). When it comes to dropouts in VET schools, the total dropout was high in BMS (45.9%) and BHS (36.0%) (ibid., p. 81).[22]

The conclusions of this section contribute to the research questions on the organisation of measurement and the patterns of students' pathways. In Barcelona, Sofia and Vienna, the governance of VET systems is increasingly operating at the local level. Although the network

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[22] 'Dropout', in this case, means *both* changing schools *and* leaving school entirely (Document 43, p. 81).

of stakeholders is larger and denser in Vienna, the corresponding networks of Barcelona and Sofia are spreading and becoming more active. Ongoing legal reforms are expected to widen apprenticeships and facilitate recognition of prior learning in Bulgaria and Spain. Information Systems for VET (IS-VETs) become necessary when the stakeholders undertake strategic planning. Countries and cities are developing their own plans based on the available skills intelligence. Despite the well-established tradition of planning in Austria, even Vienna needs to elaborate on its own tools because the labour market and demographic composition of the city differ from the whole country.

In each region, sparse pieces of research indicate that transitions from compulsory to vocational education and training (VET) are intricate. Concerns with early leaving and gender imbalances are widespread. Although school systems manage to enrol the majority of leavers in further education programmes, the probability of successful completion remains a challenge. Increasing evidence suggests that the specialities of VET are strongly stereotyped according to very rigid gender archetypes.

Databases on local VET labour markets in Barcelona, Sofia and Vienna

Integrated databank of VET internships in Catalonia

The Catalan Council of Chambers of Commerce has operated the Integrated Databank (qBID) for more than two decades. This register tracks all administrative operations where VET providers and employers collaborate to set up internships for VET students.

Initially, this register compiled information about school-based VET courses, but it is progressively including data from training programs run by the public employment service.

This task is commissioned and funded by the Education Ministry and the Employment Agency of Catalonia, which own the information.

This data serves as a valuable basis for measuring various aspects of VET in Catalonia, including:

- The socio-demographic profile of students: e.g., location of students and VET providers; gender and age of students across all programs and branches.

- The characteristics of the internships: e.g., duration, location, vacancies, and successful completion rates of internships offered by all VET providers, programs, and branches.
- The job positions of a sample of graduates a few months after completing their program.

Potential analysts of the intelligence produced by the Integrated Databank (qBID) include internship tutors, heads of VET providing institutions, public employment service officers, and academic researchers.

Barcelona Activa database

Barcelona Activa (https://www.barcelonactiva.cat/) is the public employment service of the city. The municipality oversees the service, which is also coordinated with the wider Catalan Employment Service.

In Spain, public employment services deliver vocational education and training (VET) apart from school programmes. They have organised active labour market policies at the local and regional levels for decades. Their activities include training, guidance, labour market intermediation and promoting entrepreneurship.

Barcelona Activa generates a register of the adult population that takes training in the city. The data cover the following themes:

- The socio-demographic profile of students, e.g., location of students and VET providers; gender and age of students across all programs and branches.
- The features of the training programmes, basically, distinguishing whether the programmes offer professional qualifications, are linked to strategic sectors, are targeted to young beneficiaries, teach foreign languages, or deliver short-term in-service training (e.g., occupational risks).

In the city, employment is closely aligned with a set of strategic sectors. The service creates synergies with some of them. For example, it participates in professional development workgroups in IT (https://www.cercletecnologic.cat/), disseminates the training actions launched by the Energy Efficiency Cluster of Catalonia (https://clusterenergia.cat/formacions/) and delivers online courses to the retail sector (https://empreses.barcelonactiva.cat/formacio-

i-programes-per-al-comerc). Thus, the database has a strong potential to complement the general activities of an employment service with these fine-grained, purposeful, and strategic initiatives.

Barcelona Activa is an associated partner of project AIVET. This post draws on a description of the database that the officers of the service have kindly shared with us.

Databases in Vienna

In Europe, many young adults find that Vocational Education and Training (VET) is a viable option at important biographical crossroads. The dilemmas are more visible in a city such as Vienna, where the population is much younger than in many other European regions and a large percentage of this young population was born in another country. In 2023, 19.8% of its population were aged 15-29 (Eurostat, 2024). Of these 15-29-year-olds, 38.9% were not born in Austria (Statistics Austria 2024; own calculations).

In the city, two key VET stakeholders– Statics Austria and the public employment service (AMS) – monitor the system through indicators. While both monitor employment and unemployment indicators, Statistics Austria offers more comprehensive data on education and AMS on the demand and supply side of apprenticeships as well as participation in further training programs.

The STATcube tool of Statistik Austria reports on the following items, among many others:

- the maximum educational level of the population (i.e., primary, apprenticeship, secondary and tertiary education);
- the numbers of students and teachers in all types of schools, including vocational schools;
- the participation of the population aged 25 to 64 in education and training in the last 12 months; and
- the percentage of employees participating in vocational training courses based on the employees of all companies.

At the same time, the public employment service (AMS) monitors the ongoing trends in the labour market at the national and local levels. AMS regular reports track employment, unemployment, job vacancies and the apprenticeship market.

This array of data entails a great potential to map out the trajectories of individuals. Integrated analyses could show who chooses apprenticeships and further education at different ages and what they do at the end of these programmes. The AIVET project is exploring such potential in several cities.

However, the situation in Vienna reveals blind spots that remain elusive within this data structure. As Vienna has a high share of foreign-born youths, educational permeability remains an issue. Particularly, data does not fully account for a lack of formal recognition of education previously attained in their country of origin or previous country of residence. This means that a foreign-born young adult may have attained formal vocational training in their country of origin, but they might only be formally recognised as having compulsory educational attainment in Austrian statistics and the labour market. This issue mostly pertains to young adults educated and trained outside the EU as the European Qualification Framework (EQF) has attempted to tie up these loose ends between its member states.

An additional issue, specific to Vienna, is that it is the only Austrian region with more apprenticeship demand (apprenticeship seekers) than supply (available apprenticeship positions). For every 10 available apprenticeship positions, Vienna has 35 persons looking for a position (cf. AMS, 2024, p. 4). This creates a competition for positions on the apprenticeship market that is mostly counteracted by an emphasis on supra-company apprenticeships where apprentices are trained across multiple companies (see waff, 2024, p. 19).

In conclusion, the Viennese VET system faces many challenges – both on a demographic and a labour market level – that are more pronounced than in other European and Austrian regions. The AIVET project could offer a sensible way of addressing some of the challenges based on available statistical data.

The Bulgarian Employment Agency and National Agency for Vocational Education and Training

The Bulgarian Employment Agency (BEA) is the public provider responsible for implementing employment policies, vocational training, and labor market integration at the

local level. In Sofia city there are 10 regional divisions of the agency called "Bureaus of Labor" (Бюро по труда) working directly with the citizens. Their function is to register individuals actively seeking employment, provide information, provide professional and motivation training, etc. Additionally, vocational education and training (VET) outside traditional school programs is organized by the National Agency for Vocational Education and Training (Национална агенция за професионално образование и обучение, NAVET).

The BEA and NAVET collect data on:

1. **Unemployed citizens actively seeking jobs.** Socio-demographic variables such as gender, education, age, location. etc.

2. **Job vacancies from the private sector.** It contains job description, location, work hours, type of contract, etc.

3. **Vocational training centres.** It provides information about every education center in the country. It includes names, addresses, courses in which professional field they provide, etc.

The BEA and NAVET collaborate closely with local and regional stakeholders to align their initiatives with Sofia's strategic sectors, such as IT, energy efficiency, and green technologies. Through professional and motivational training, these institutions prepare the workforce to meet the demands of these industries. They also collaborate with The Bulgarian Industrial Association - Union of the Bulgarian Business (BIA).

Webs crapping InfoJobs.net and Jobs.bg

InfoJobs.net (Spain) and Jobs.bg (Bulgaria)

InfoJobs, Spain's premier job portal, as well as Jobs.bg for Bulgaria offer a robust dataset that can be leveraged through web scraping to support the data-driven goals of the AIVET project. The platform hosts data-rich job postings across sectors such as technology, healthcare, education, and retail:

- **Job descriptions**: Titles, responsibilities, and required qualifications.
- **Skills and certifications**: Details on the skills sought by employers, providing insights into labor market trends and mismatches.
- **Salary information**: Range and averages for roles, allowing for salary benchmarking across sectors.

- **Employer profiles**: Company descriptions, size, and ratings, giving context to hiring practices.
- **Application metrics**: Number of applicants per job, frequency of job postings, and timelines for hiring.

How Web Scraping Addresses AIVET's Needs

Web scraping these platforms aligns directly with the AIVET project's objectives by providing large volumes of structured and unstructured data, which can then be integrated into its AI-driven tools. Specifically:

1. **Quantitative Insights**: Structured data, such as job descriptions and application statistics, can be used to identify patterns in job demand and skills shortages.
2. **Regional Disparities**: Location-based data highlights geographic inequalities in job opportunities and helps tailor VET programs to specific local needs.
3. **Qualitative Enrichment**: Employer reviews and feedback on CVs provide qualitative insights into hiring preferences and perceived gaps in VET graduate skills.
4. **Dynamic Labor Market Analysis**: Real-time scraping ensures that the AIVET project uses the most up-to-date labor market intelligence, improving decision-making and the adaptability of VET programs.
5. **Triangulation with Qualitative Data**: Combining scraped data with interviews and focus groups as planned in AIVET will allow for deeper triangulation, strengthening the project's findings.

By leveraging data scraped from InfoJobs.net and Jobs.bg, AIVET can effectively meet its goals of enhancing skills intelligence, aligning VET training with labor market needs, and fostering greater inclusion and equity in vocational education systems across diverse European contexts.

The conclusion of this section complements the observations of the previous one on the measurement of the outcomes of VET systems. In fact, an overview of the local databases must notice an emerging challenge of multilevel governance of VET in the European Union. Although CEDEFOP has clarified the meaning of 'skills intelligence' and the local authorities and stakeholders of VET start to fill many informational gaps, the current state of the art indicates that articulating these sources of intelligence remains an extremely demanding endeavour.

Certainly, the local databases, monitoring reports and publications partially report on key dimensions of the CEDEFOP (2024) model such as employment trends and future jobs, but skills and learning, digitalisation and workplace trends remain elusive at the local level. Online job advertisements also provide a source of local information, which sheds light on skills and learning. However, the report can hardly conclude that the available information covers such an indispensable theme as the articulation of VET programmes with the needs of employers. Although the academic literature found some initiatives in this vein, the grey literature does not report on any ongoing initiative in Barcelona, Sofia and Vienna.

This point does not put the blame on the local actors at all. If the diverse networks of stakeholders and the different traditions of managing VET that these three cases represent have not yet developed systematic knowledge about the bridges between VET and labour market skills at the local level, further reflection is urgent. CEDEFOP has mapped out the concept of skills intelligence, many authorities and stakeholders are collecting relevant information, but the available measures are not clearly rooted in meaningful conventions that really help the providers, students and regulators of VET to perform their tasks.

Statistical analyses of local VET labour markets

The expansion of VET programmes is changing the distribution of instructional levels in Spain. While in 2022 enrolment rates still lagged behind the EU average (12% in the country compared to 25% in the EU), the number of VET students had increased by about thirty percentual points since 2017. Previously, many sixteen- year- olds left education and training at the end of compulsory education, but a growing group have enrolled in the upper-secondary, school-based programmes (*Cicles Formatius de Grau Mitjà*) in the last decade. At the same time, tertiary- level, school- based programmes (*Cicles Formatius de Grau Superior*) have attracted students in their twenties and above, with 18% female and 15% make students exceeding 35 years of age (Ministry of Education and VET, 2023).

In this section, we present a statistical analysis of VET students and interns in Barcelona as documented by the Integrated Data Bank, curated by the Catalan Council of Chambers of Commerce. URL https://www.empresaiformacio.org/sBid The information

measures various aspects such as their educational pathways, the conditions of their internships and their job perspectives.

The section reports on the results of bivariate and multivariate analyses. To illustrate the changes between the global lockdowns in 2020-2021 and the subsequent years, we selected three periods: 2020-2021, 2021-2022, and 2022-2023. While the database includes 305.712 observations of all VET students in Catalonia during this period, one analysis focuses on 66.764 observations corresponding to the VET students living in the city of Barcelona. The findings compare the gender, age, geographical origin, prior instructional level, and neighbourhood of the students of upper-secondary (intermediate VET, IVET) and tertiary-level (higher VET, HVET) programmes in the city. Table 3 provides a description of the variables used in the following analysis and the procedure through which the derived variables were obtained. These were obtained from three sources:

- Registry: registry of the internship agreements (Barcelona Chamber of Commerce).
- Survey: insertion survey after finishing the studies. When a variable is available for both the registry and the survey, we select the survey variables, as they are likely to contain fewer errors than the registry data.
- INE: data from the Spanish National Statistics Institute (INE), accessed through the ineAtlas R package. The data comes from each census tract, but they were aggregated at the postal code level. Therefore, the measures for the postal codes are the mean of the measures for the census tracts within a postal code, assuming the population sizes of the tracts within a postal code are similar.

Table 3 Glossary of variables

Name of the variable	Description	Obtained from
ID	ID of the student anonymized using a hash function. Used to link data from the registry and the surveys.	Registry and surveys
Gender	Gender of the student. Just 2 options are given: Man and Woman.	Survey
Age	Rounded age at entry. It is not the actual age of the student, but the age most	Registry: Entrance year

	people born the same year have when entering the degree (e.g. people born in 2002 entering the degree in 2020 are assumed to be 18 y.o., independently of their actual birthdate).	minus birth year.
Study_degree	Dichotomic variable that indicates whether the student has studied an intermediate-level VET (IVET) or a higher-level VET (HVET)	Survey
Family	Occupational family of the VET.	Survey. Aggregated according to the official Catalan classification.
Nationality	Dichotomic variable that indicates whether the student is considered as Spanish or Foreign. Note: this variable has a remarkable issue. Students are not considered as foreigners if they have been in the Catalan education system for 2 or more year. Therefore, among the people considered as "Spanish", there may be people who don't actually possess the Spanish nationality.	Survey. Recode: Stranger (Yes/No) to Nationality (Foreign/Spanish).
Center_ownership	Dichotomic variable that indicates whether the school is public or private.	Survey
Student_PC	Postal code where the student lives. It has been used to link each student to the economic information of their postal code.	Registry
Mean_income_student_PC	Mean per capita income of the student's postal code.	INE: average of the mean per capita income of the census tracts within the student's postal code.
Studies_origin	Initial level of studies of the student before the VET. Note: this is the original variable, so it is not translated to English. It has been	Registry

	recoded in ISCED_origin, but it has been preserved for traceability purposes	
Year	Academic year when the internship was carried out.	Registry
Agreement_code	Code of the internship agreement	Registry
Validated_hours	Hours of the original internship agreement completed by the student and validated by the company.	Registry
Validated_hours_ with_extension	Total hours of internship agreement completed by the student and validated by the company (hours of the original internship agreement and the extension).	Registry: original agreement validated hours plus extension validated hours.
Company_type	Type of company where the student carried out their internship. Note: the 10 different company types were recoded to 'Private sector', 'Public sector' and 'Third sector'.	Registry
Workplace_type	Type of workplace. Adds more detail to the Company_type variable. Note: not translated.	Registry
Current_situation	Current study/work situation of the student within 1 year after finishing the studies. 4 options: Continue studying Looking for a job Studying and working Working	Survey
Current_studies	Current studies within 1 year after finishing the VET, if the student decided to continue studying.	Survey
Relation_job_studi es	Yes/No: if the student is currently working, they are asked whether their current job is related to the VET they studied.	Survey
Job_before_studie s	Yes/No: if the student is currently working, they are asked whether they had their current job before starting the VET.	Survey

Studies_helped_obtain_job	Yes/No: if the student is currently working, they are asked whether the VET helped them find their current job.	Survey
Strategy_to_job	If the student is currently working, the pathway they used to find their current job.	Survey
Contract_type	If the student is currently employed, the type of contract they have.	Survey: learning and internship contracts have been reclassified to "Other".
Work_schedule	Dichotomy variable: if the student is employed, whether their job is full-time or part-time	Survey
Net_salary	Net income of the student, classified in 4 ranges: <900 €, 900-1200 €, 1200-1500 €, >1500 €.	Survey
Gini	Gini index of the student's postal code.	INE: average Gini index of the census tracts within the student's postal code.
P80P20	P80/P20 rate of the student's postal code. It corresponds to the the income of the 20% richest share of the population divided by the income of the 20% poorest share of the population. It is a measure of inequality.	INE: average P80/P20 of the census tracts within the student's postal code.
ISCED_origin	Educational level when entering the VET, coded according to the ISCED classification.	Registry: recode of the variable Studies_origin according to the ISCED classification.
Overage	Overage of students (compared to the minimum entrance age) when entering the VET.	Registry: Age - 16 for IVET Age - 18 for HVET

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Overage_factor	Overage recoded as a factor.	Overage, aggregating all values higher than 6 as ">6"

The annex of the report includes portrays the variables and the main bivariate effects, providing a fine-grained account of the multivariate analyses. This section is based on a selection of those findings.

Upper-secondary, intermediate (IVET) programmes enrol more overage and more male students than tertiary-level, higher programmes (HVET). Overage students are more common in the specialties of energy and water, health services and food industries. Female and male students are distributed very differently. While students of health and community services come from low-income more frequently than high-income neighbourhoods, students of sports normally live in higher-income neighbourhoods. Private schools enrol students from higher-income neighbourhoods, although about one third of the students living in low-income neighbourhoods attend a private school. Overage students are more common in public schools and normally live in lower-income neighbourhoods.

Figure 2 shows the distribution of women among the specialties or vocational families in Barcelona. This data is essential to understand the bivariate and multivariate analyses presented later in the section. Certain specialties are strongly associated with gender. Women are the majority in health services, performing arts, graphic arts, plastic arts and design, food industries, community services (officially, socio-cultural and community services) and beauty. Administration and management, as well as chemistry, exhibit gender parity. Male students dominate in all other fields, which are related to manufacturing and agriculture.
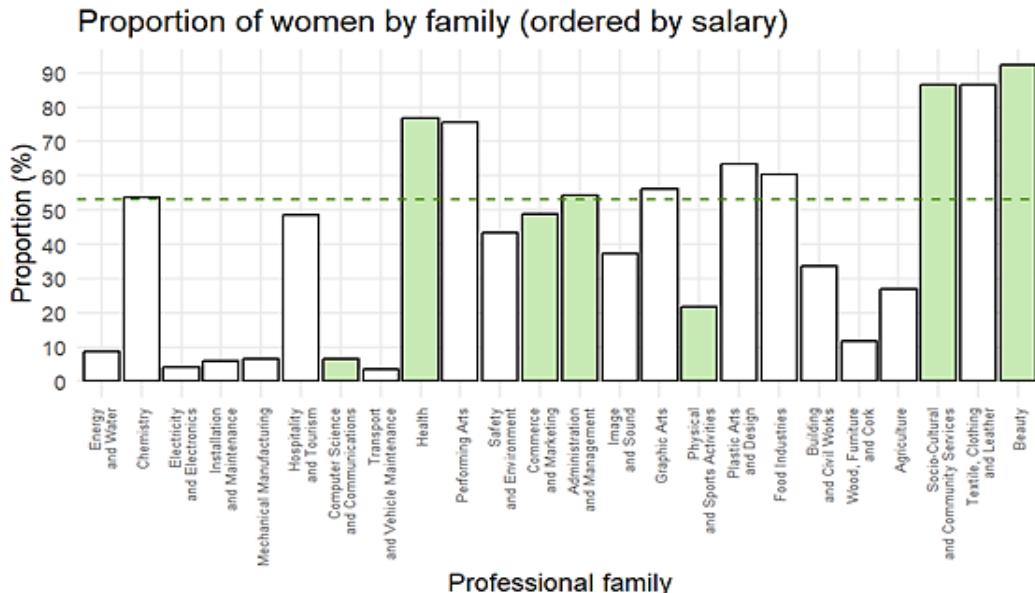
Figure 2 Proportion of women by vocational family (ordered by salary). Only the families with relative frequencies higher than 5% have been coloured.

Annex III also shows that the internships of VET students take a similar number of days across these socio-demographic and institutional variables with some remarkable exceptions. In general, native-born and slightly overage male students who entered in VET programmes with a ISCED2 instructional level do relatively longer internships than the rest.

Annex III identifies significant gaps regarding employment. Overage students are more likely to find jobs through examinations and hearings. Educational levels often correlate with wages, with male graduates earning higher salaries than female graduates and finding jobs more aligned with their training. Over half of the graduates in IT and beauty have indefinite contracts, while only 40% of graduates in the feminised field of health achieve the same. Wages are higher in the masculinised field of IT and the feminised field of health but significantly low in feminised fields such as community services and beauty. Overage students are more frequently offered indefinite contracts after graduation.

An array of multilevel logistic models (MLM) explore access to VET programmes, students' internships and their job prospects in Barcelona in the following paragraphs. Specialties (or occupational families, according to the official label) are included as random effects to account for hierarchical structures.

Firstly, students who have only finished low secondary education (ISCED2) and students with higher academic background (e.g., ISCED3) choose different upper-secondary school-based IVET programmes. Below, table 4 informs of the results of a multilevel logistic model with random effects in which ISCED education level at entry is the output variable and ISCED level 2 is the reference value. The effects of the average income of the neighbourhood and the geographical origin are significant, but the underlying pattern remains unclear.

Table 4 Academic background at entry (odds ratio of the MLM)

	OR	Odds variation (%)	Significance
(Intercept)	0.406	-59.353	***
Gender - Women	0.991	-0.916	
Income quintile - Q2	1.136	13.582	***
Income quintile - Q3	0.997	-0.252	
Income quintile - Q4	1.209	20.861	***
Income quintile - Q5	1.235	23.537	***
P80P20	0.924	-7.601	
Year 2021/2022	1.505	50.52	***
Year 2022/2023	3.02	201.97	***
Year 2020/2021:Nationality - Foreign	1.672	67.24	*
Year 2021/2022:Nationality - Foreign	0.902	-9.763	
Year 2022/2023:Nationality - Foreign	0.652	-34.786	***
n = 31444; df = 31431 AIC = 40740.1; R2 (cond.) = 0.098; R2 (marg.) = 0.058; ICC = 0.042			
. CL > 90% | * CL > 95% | ** CL > 99% | *** CL > 99.9%			

The patterns differ greatly among specialties or vocational families. The odds of entering intermediate IVET programs with an ISCED3 credential, compared to ISCED2,

are high in beauty, sports, and health. However, community services and IT show the opposite trend. As illustrated in Figure 3, the 'blue' specialties attract students who have completed upper-secondary education or higher, while many students with only a lower-secondary education degree enrol in the 'red' specialties.
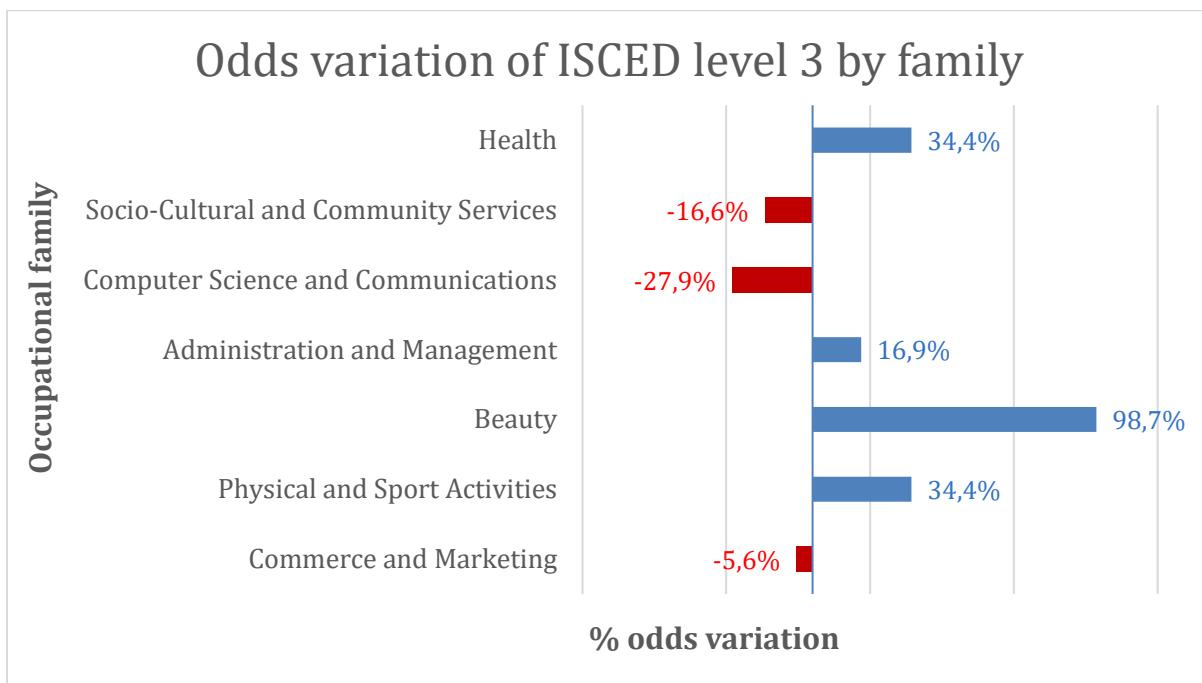
Figure 3 % Odds variation of ISCED level 3

Secondly, the factors of access to either upper-secondary IVET or tertiary-level HVET programmes have varied in recent years. Table 5 summarises the results of a multilevel model with random effects in which type of VET school-based programmes (either IVET or HVET) are the output variable with IVET as the reference value. The neighbourhood income and the gap between the 80th and the 20th income percentiles of the residential neighbourhood influence the preference for HVET school-based programmes. Choosing a private school was crucial in the 202-21 and the 2021-22 academic years, but this was not the case in the following academic year.

Table 5 Type of VET school-based programme (odds ratios of the MLM)

	OR	Odds variation (%)	Significance
(Intercept)	0.34	-66.043	***
Gender - Women	1.146	14.645	***
Nationality - Foreign	0.829	-17.051	**
Income quintile - Q2	1.014	1.408	
Income quintile - Q3	0.956	-4.391	
Income quintile - Q4	0.978	-2.186	
Income quintile - Q5	0.871	-12.917	***
P80P20	1.695	69.47	***
Year 2021/2022	0.829	-17.111	***
Year 2022/2023	0.512	-48.777	***
Year 2020/2021: Private school	1.399	39.909	***
Year 2021/2022: Private school	1.169	16.949	***
Year 2022/2023: Private school	1.06	5.97	.
n = 60442; df = 60428 AIC = 77336.2; R2 (cond.) = 0.317; R2 (marg.) = 0.029; ICC = 0.296			
. CL > 90% | * CL > 95% | ** CL > 99% | *** CL > 99.9%			

Once again, variable patterns are noticeable among specialties or vocational families. Thus, the 'blue' ones reflect higher odds of enrolling in HVET in figure 4, with community services and marketing being the more salient cases.
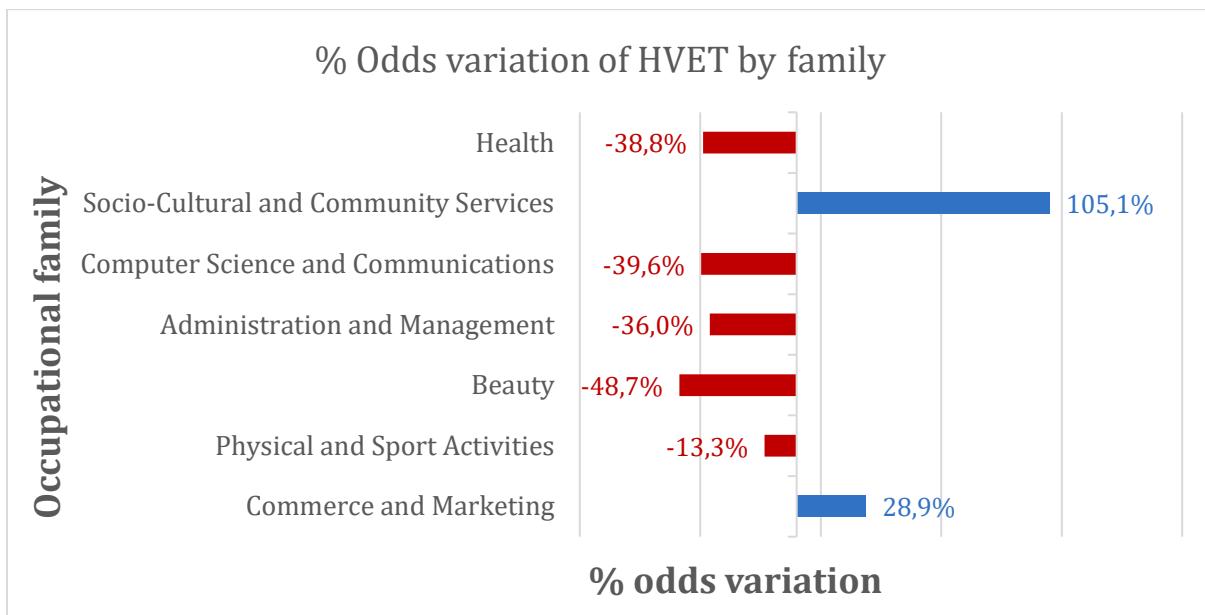
Figure 4 % Odds variation of HVET (random effects of the MLM by selected families)

Thirdly, the socio-economic level of the neighbourhood seems to greatly contribute to enrolment in private schools. This is an indirect and broad measure of socioeconomic status that represents ZIP code income level, but this is the unique measure of socioeconomic intake at our disposal. In table 6, the multilevel model with random effects takes the type of school as the output variable, with public school as the reference value. As a rule, people living in higher-income neighbourhoods as well as in neighbourhoods with the more significant gaps between the better-off and the worst-off (P80/P20 ratio), people undertaking a HVET and having an ISCED level 3 at VET entrance are more likely to choose a private school.

Table 6 Studying at a private school (odds ratios of the MLM)

	OR	Odds variation (%)	Significance
(Intercept)	0.02	-97.973	***
Gender - Women	0.805	-19.456	***
Nationality - Foreign	0.688	-31.246	***
Income quintile - Q2	1.269	26.882	***
Income quintile - Q3	1.497	49.655	***
Income quintile - Q4	1.889	88.92	***
Income quintile - Q5	2.246	124.584	***
P80P20	2.628	162.848	***
Study degree - HVET	1.149	14.883	***
ISCED origin - 1	0.163	-83.7	***
ISCED origin - 3	1.1	9.981	***
ISCED origin - 5	0.271	-72.921	***
ISCED origin - 6	0.545	-45.461	***
Year 2021/2022	0.949	-5.146	*
Year 2022/2023	0.886	-11.374	***
n = 60306; df = 60290 AIC = 75431.7; R2 (cond.) = 0.506; R2 (marg.) = 0.033; ICC = 0.49			
. CL > 90% | * CL > 95% | ** CL > 99% | *** CL > 99.9%			

Figure 5 plots linear increases of the likelihood to enrol in VET private schools as neighbourhood incomes rise. The effects are more pronounced among male students and students of tertiary-level HVET programmes.
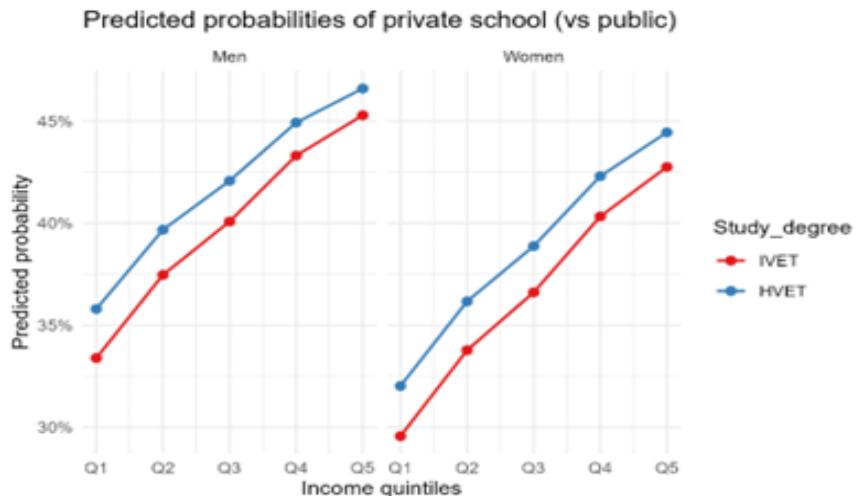
Figure 5 Predicted Probabilities of enrolment in a private school

Fourthly, the patterns of overage enrolment are complex and variable in IVET and HVET programmes depending on the specialties. To study the determinants of being overage, tables 7 and 8 use a dummy variable which takes the value of 1 (being overage) and 0 for students of the corresponding school age as reference category. The tables report the odds ratios of overage students in IVET and HVET programmes, highlighting the different effects at each level of vocational education.

Table 7 shows that many factors impinge on the probability of being overage in upper-secondary IVET programmes, with the effects of the years varying quite significantly. Socio-demographic groups such as men and native-born students, graduates from ISCED3 programmes as well as the intake of public schools are very likely to be overage. The same probability is high among students living in neighbourhoods where income is more polarised.

Table 7 Overage students in IVET (odds ratios of the MLM)

	OR	Odds variation (%)	Significance
(Intercept)	0.171	-82.936	***
Gender - Women	0.885	-11.548	***
Nationality - Foreign	0.758	-24.166	***
Income quintile - Q2	1.092	9.152	*
Income quintile - Q3	0.972	-2.837	
Income quintile - Q4	0.949	-5.091	
Income quintile - Q5	0.961	-3.915	
P80P20	2.306	130.574	***
Private school	0.67	-33.022	***
ISCED level 3	2.864	186.423	***
Year 2021/2022	0.923	-7.733	**
Year 2022/2023	1.26	25.958	***

Table 8 reproduces the same analysis for tertiary-level HVET programmes. Here, the multilevel logistic model (MLM) excluded ISCED levels because those above ISCED3 are residual and mislead the analysis. This variable anyway did not add much information. In general, the patterns are analogous in IVET and HVET programmes.

Table 8 Overage students in HVET (odds ratios of the MLM)

	OR	Odds variation (%)	Significance
(Intercept)	0.401	-59.914	***
Gender - Women	0.791	-20.884	***
Nationality - Foreign	0.746	-25.412	**
Income quintile - Q2	0.997	-0.338	
Income quintile - Q3	0.997	-0.314	
Income quintile - Q4	0.991	-0.92	
Income quintile - Q5	0.936	-6.406	
P80P20	2.104	110.415	***
Private school	0.666	-33.439	***
Year 2021/2022	1.006	0.632	
Year 2022/2023	1.098	9.83	**
n = 28896; df = 28884 AIC = 37261.2; R2 (cond.) = 0.056; R2 (marg.) = 0.023; ICC = 0.034			
. CL > 90% | * CL > 95% | ** CL > 99% | *** CL > 99.9%			

Below, two figures reproduce similar effects of the income polarisation of neighbourhoods, gender and type of school. In both IVET and HVET programmes, the students who live in neighbourhoods with a more pronounced gap between the 80th and the

20th income percentiles, and those who are enrolled in public schools, undertake VET programmes at an older age than specified, with men doing so more often than women.
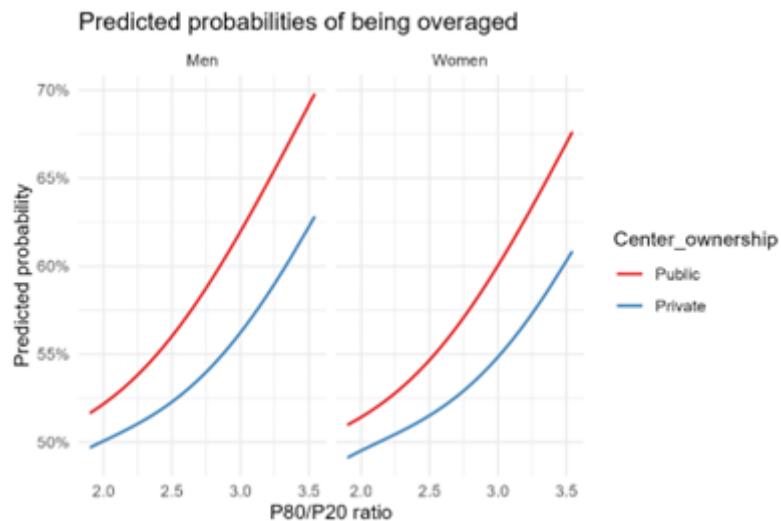
Figure 6 Predicted Probability of being overage by P8020 of neighbourhood, type of school and gender in upper-secondary (IVET) school-based programmes
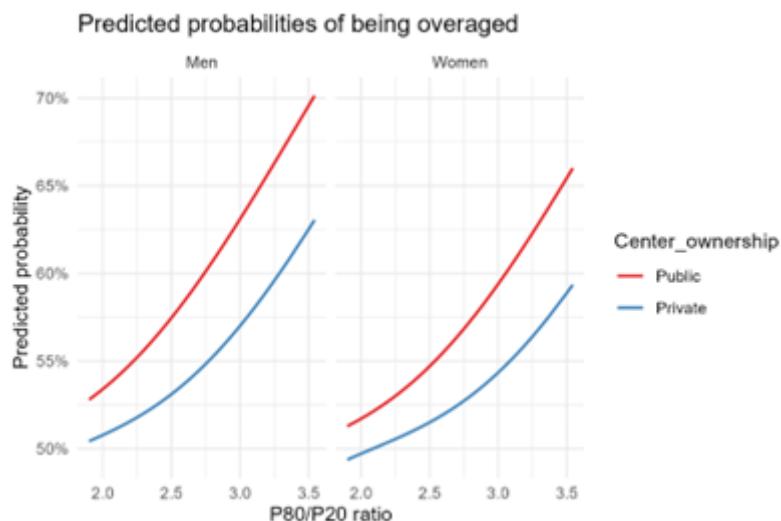
*Figure 7 Predicted Probability of being overage by P8020 of neighbourhood, type of school and gender in tertiary-level (HVET) school-based programmes*

All the previous similarities notwithstanding, the specialties or vocational families make a difference. A comparative reading of figures 8 and 9 clearly shows variable patterns of the 'blue' bars that indicate an increase in the odds of being overaged and the 'red' bars

that indicate a decrease in the odds of being overaged. For both IVET and HVET, enrolling in community services or sports reduces the odds of being overaged, while enrolling in beauty or commerce increases the odds of being overaged. The pattern for health services and IT is reversed when comparing IVET and HVET: health increases the odds of being overaged for IVET, while it decreases the odds of being overaged for HVET; IT decreases the odds of being overaged for IVET and increases the odds of being overaged for HVET.
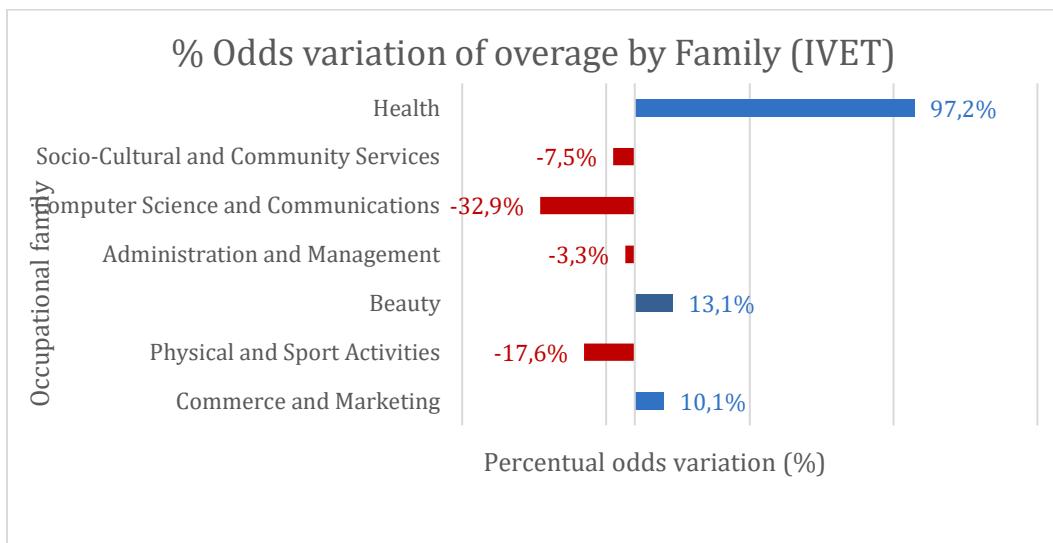

Figure 8 % Odds variation of being overage in upper-secondary (IVET) programmes
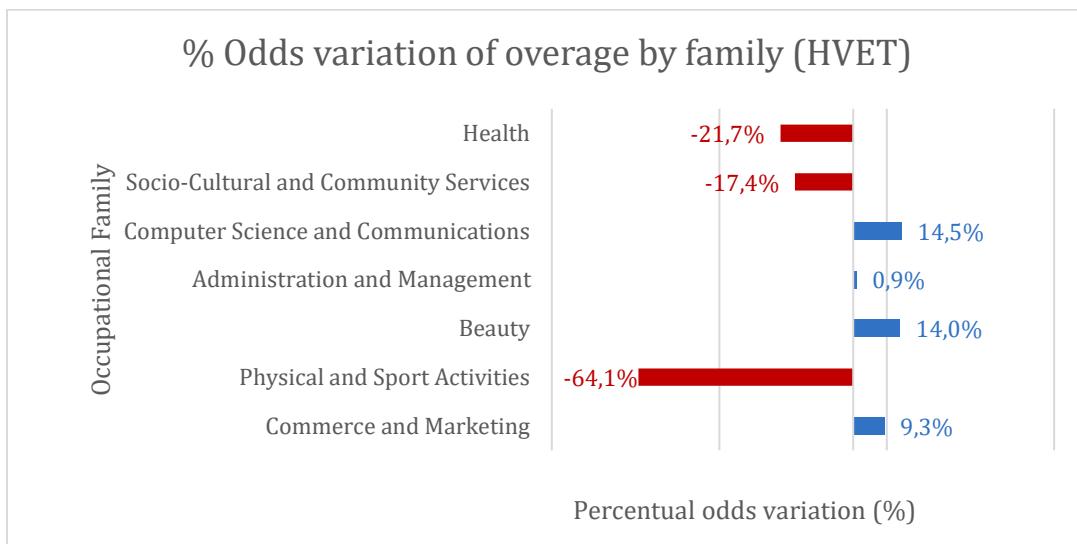

Figure 9 % Odds variation of being overage in tertiary-level (HVET) programmes (random effects of the MLM, selected families)

Fifthly, different students do internships in the public, private and the third economic sectors. Generally, public- school and female students are more likely to gain professional

experience in the public sector. However, specialties or vocational families also play a significant role.

Tables 9 and 10 present multinomial models that compare the probability of doing an internship in the public and the third sectors with the probability of doing one in the private sector. Overall, male students, students at private schools and those living in neighbourhoods with a higher income are more likely to intern in the private sector. The only exception is the specialty of sports, where about half the students do internships in the private and the third sectors.

Table 9 Doing an internship in the public sector (odds ratios of the MM)

	OR	Odds variation (%)	Significance
(Intercept)	0.2677	-73.317	***
Gender - Women	2.3663	136.268	***
Overage - Yes	0.8894	-10.577	***
Center ownership - Private	0.8447	-15.289	***
Nationality - Foreign	0.8831	-16.948	*
Income quintile - Q2	0.8661	-13.88	***
Income quintile - Q3	0.8878	-12.15	***
Income quintile - Q4	0.8033	-19.706	***
Income quintile - Q5	0.7	-28.27	***

	17		
Study degree - HVET	1.0229	2.857	
Year 2021/2022	1.0005	0.518	
Year 2022/2023	1.0054	5.442	*
n = 60442; df = 60430 AIC = 106030.9; R2 (cond.) = 0.036; R2 (marg.) = 0.036; ICC = 0.413			
. CL > 90% | * CL > 95% | ** CL > 99% | *** CL > 99.9%			

Table 10 Doing an internship in the third sector (odds ratios of the MM)

	OR	Odds variation (%)	Significance
(Intercept)	0.0122	-87.822	***
Gender - Women	1.549	54.873	***
Overage - Yes1	0.8838	-16.235	***
Center ownership - Private	1.422	42.188	***
Nationality - Foreign	1.0885	8.496	
Income quintile - Q2	1.0661	6.092	
Income quintile - Q3	1.0037	3.732	
Income quintile - Q4	1.1555	15.483	***
Income quintile - Q5	1.1147	14.741	***
Study degree - HVET	1.335	35.019	***
Year 2021/2022	1.1135	13.546	***
Year 2022/2023	1.26	26.029	***

n = 60442; df = 60430
AIC = 106030.9; R2 (cond.) = 0.036; R2 (marg.) = 0.036; ICC = 0.413

. CL > 90% | * CL > 95% | ** CL > 99% | *** CL > 99.9%

Figure 10, derived from a correspondence analysis, maps out the most common specialties along the sectors of internships.
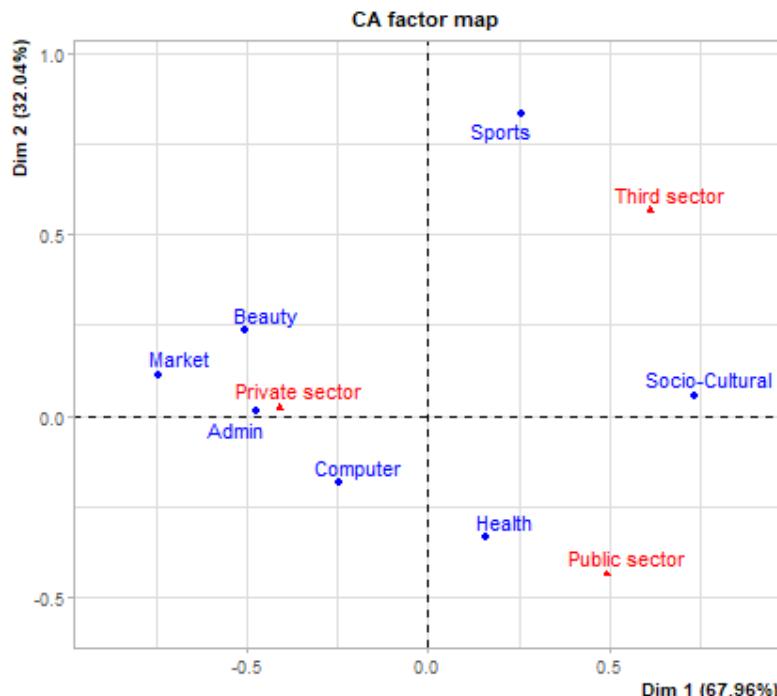
Figure 10 Factor map of VET specialties and sectors of internships

Sixthly, VET graduates do not have the same opportunities to find high-quality jobs, with middle-class and male students being advantaged compared to the other ones. Although specialties of vocational families reduce this gap, this variable does not counteract the general effect.

As described in the annex, a numeric measure of job quality was created using Correspondence Analysis, considering net monthly income and type of contract. Since

income information for part-time workers is unavailable, only those working full-time within one year after finishing their studies were included, reducing the sample to 11,549 observations. Additionally, the self-employed category was removed from the analysis as it is very small and distorts the job quality measure.

Several tables report on the effects in the annex. Here, a few figures portray the big picture.

Men find much better jobs than women, private school students fare better than public school students, and tertiary-level HVET graduates outperform upper-secondary IVET graduates.
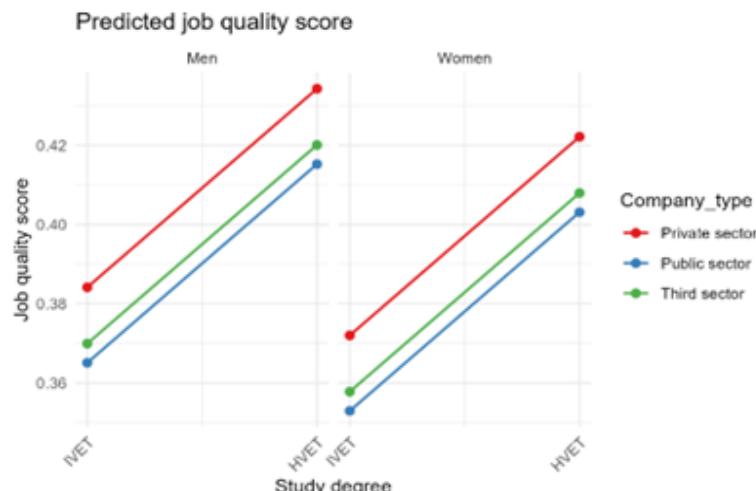
Figure 11 Predicted job quality score by study degree,

Overage students (1) are better than students graduated at the corresponding age (0). The correlation shows that the positive impacts of private schools and more affluent neighbourhoods are replicated within both age groups.
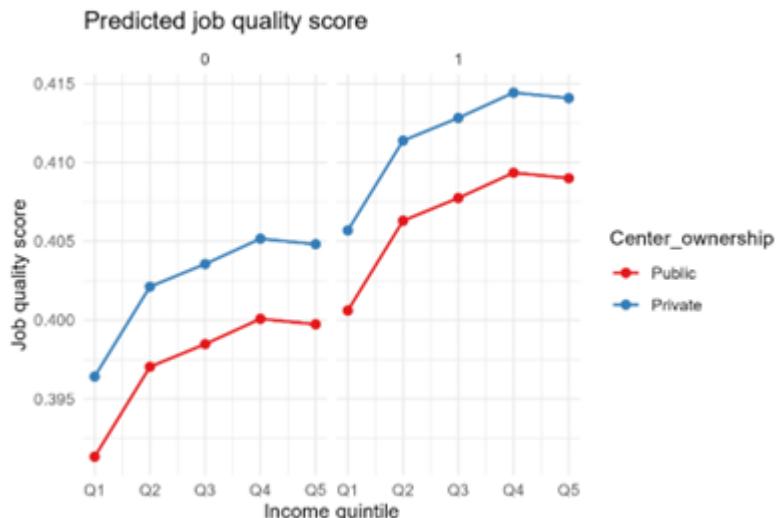
Figure 12 Predicted job quality score by income quintile, school ownership and being overage

A comparative analysis of the more popular specialties or vocational families indicates that two stand out. While health services have a positive impact, IT is strongly associated with higher- quality jobs.
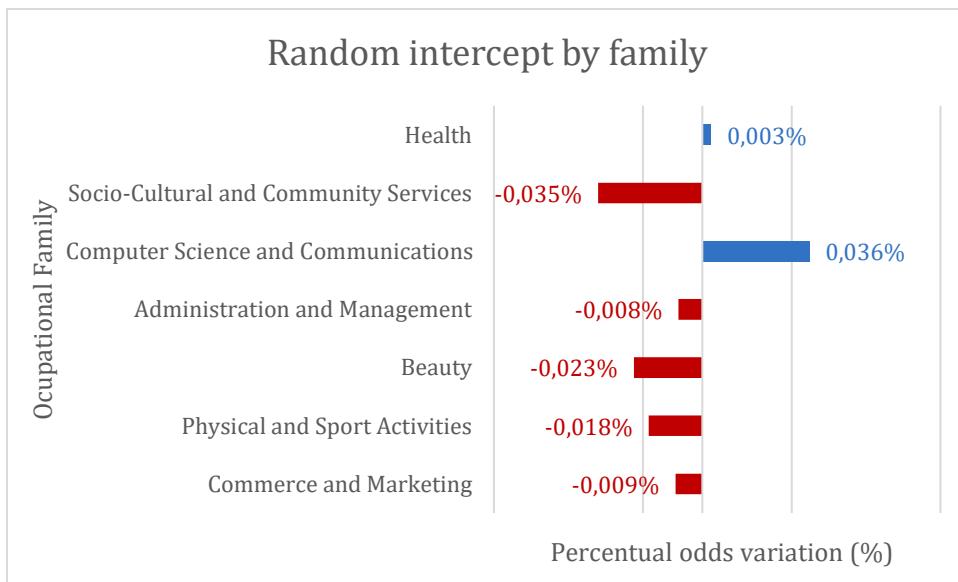
Figure 13 Job quality and VET specialties (random intercepts of the multilevel model, selected specialties or families)

Finally, the probability of finding a job related to the student's specialty varies along socio-demographic lines. A remarkable result is that gender does not influence this variable. In contrast, job relevance is much lower among those living in low-income neighbourhoods, doing internships in the public and the third sectors, being overage,

coming from a foreign country and graduating from upper-secondary IVET programmes. However, the health and IT fields stand out for favouring job relevance.

Figures 14 and 15 plot the socio-demographic effects.
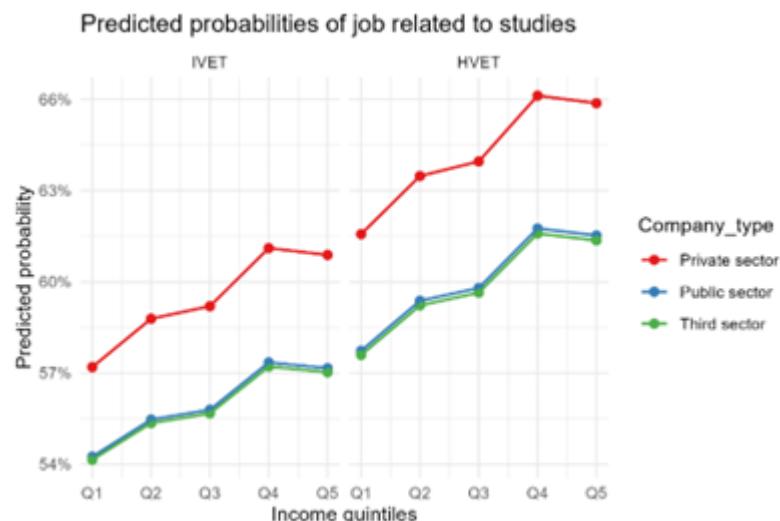
Figure 14 Job being related to the studies
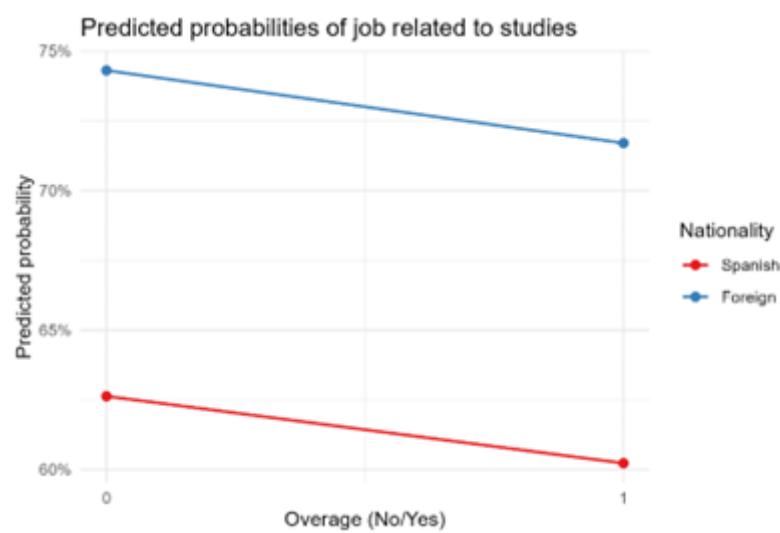
Figure 15 Job being related to the studies by being overage and nationality

Figure 16 compares specialties or vocational families.

% Odds variation of job relateed to studies by family

Health — 38,9%
Socio-Cultural and Community Services — -36,0%
Computer Science and Communications — 102,8%
Administration and Management — 5,3%
Beauty — -69,8%
Physical and Sport Activities — -68,1%
Commerce and Marketing — -23,6%

Occupational family

Percentual odds variation (%)
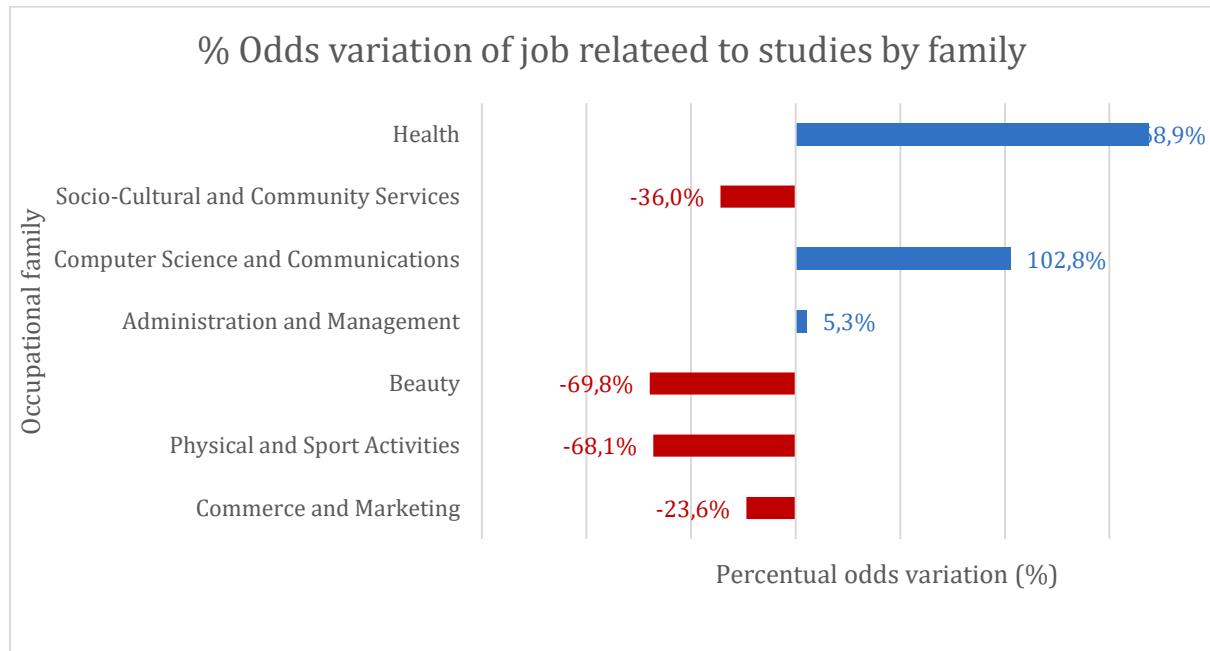
Figure 16 Job related to studies by specialty (% Odds variation of the random effects of the MLM, selected families or specialties)

To wrap up, this section has unveiled the internal stratification of VET in Barcelona and the significant differences between students of various ages. Socio-economic background remains a persistent divide across age and gender groups. Private schools likely enhance the opportunities of their students by selecting those with better-off backgrounds. Gender imbalances are pervasive, with women often accessing lower-quality jobs after graduation. Among specialties, health and IT seem to offer advantages compared to others.

Lessons Learned on Intelligence about VET in Barcelona, Sofia and Vienna

This report distinguishes two types of information systems that monitor and evaluate VET (IS-VETs): individualised IS-VETs, which use professional social media to create skills ontologies, and policy-oriented IS-VETs, which use registers and surveys to monitor national and local employment trends. It surveys the grey literature produced by local authorities and stakeholders and the available databases in Barcelona, Sofia and Vienna. One section

highlights the relevance of the data collected by the Catalan Council of Chambers of Commerce, whose Integrated Databank provides information to track recent changes of students' trajectories.

This exercise explores skills and labour market intelligence referred to VET graduates in the three cities. As Diagram 1 indicates, VET systems shape different types of intelligence, which should ideally feed further decision-making. This loop depends on how measurements are conducted and how students' trajectories are considered. The report renders two important lessons for designing this type of intelligence.

The first lesson is that measurement requires coordination. While various corporations have elaborated individualised IS-VETs to deliver up-to-date skills ontologies to employers quickly, education and employment authorities and stakeholders need more time to capture local employment trends with policy-oriented IS-VETs. The AIVET project will support this coordination by designing an AI tool that checks the comparability of the available databases at the local level.

The second lesson is that reliable measures must be sensitive to inequalities. VET systems are internally stratified because different programmes cater to different types of population. However, the previous analysis of the Integrated Databank in Barcelona unveils significant inequalities among the students of the two-year, upper-secondary and tertiary programmes in the city. The AI tool designed by AIVET will verify the robustness, and more importantly, the correctness of these measures. It will also triangulate the available quantitative information with evidence coming from interviews with VET graduates and focus groups with employers.

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Annex

Project Gantt Chart

	Dec 23-Jan 24	Feb-Jun 2024	Jul-Dec 2024	Jan-Dec 2025	Jan-Nov 2026
WP2. Reviewing intelligence on VET local labour markets	Setup				
Stakeholders and database mapping in Barcelona					
Stakeholders and database mapping in Sofia					
Stakeholders and database mapping in Vienna					
WP3. Piloting AI-driven labour market intelligence tools	Setup				
Design of Minimal Viable Prototypes of the AIVET tool					
Delphi poll with skills intelligence analysts					
WP4. Mapping the skills and the trajectories of VET graduates	Setup				
Fieldwork and analysis in Barcelona					
Fieldwork and analysis in Sofia					
Secondary data analysis in Vienna					
WP5. Bringing employers in– exploring and sharing expertise	Setup				
Fieldwork and analysis in Barcelona					
Fieldwork and analysis in Vienna					
Fieldwork and analysis in Sofia					
WP6. Showcasing what cities can learn from one another	Setup				
Participatory workshop on local skills intelligence of VET in Barcelona					
Participatory workshop on local skills intelligence of VET in Sofia					
Participatory workshop on local skills intelligence of VET in Vienna					
Training activity for analysts					

Workflow

Objective 1: Developing a well-informed VET skills intelligence AI tool at the local level

Objective 2: Triangulating information about the trajectories of the graduates and the experience of the employers

Objective 3: Engaging the stakeholders in an assessement of AI for VET skills at the local level

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