



DEVELOPING THE TALENT ECOSYSTEM FOR INDUSTRY 4.0 IN MEDIUM-SIZED INDUSTRIAL CITIES

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INTRODUCTION

Manufacturing industries are still the beating heart of many European industrial city regions. But global competition is tough, and traditional business practices are under fire, challenged by digitalization, servitization, and the drive to make manufacturing sustainable. The ongoing transformation of industry puts new demands on the **skills and competences** of people that work in the industry, but also on educational institutes in the city that educate the new **talent** flowing into the sector. Cities thus face the challenge to foster an urban/regional talent ecosystem that is future proof, in co-creation with all relevant stakeholders such as educational institutes, large companies, SMEs, and intermediaries. How to make (higher) education ready for digitalization/industry 4.0? How to keep educational programmes relevant, and improve connections between industry and education, and organise life-long learning? What places, spaces, programmes and events can be envisioned where industry and research/education meet and collaborate?

This report addresses these questions. It builds on the experiences of four European industrial cities (Bielsko-Biala, Bilbao, Tartu and Timisoara) that are united in the AS-TRANSFER network. The cities held a virtual thematic meeting about the talent ecosystem¹, in which shared good practices, but also their challenges, worries and concerns. The report is backed up by literature research and in-depth interviews with companies, educational institutes, policy makers and experts in the four cities. The report is organised as follows. First, it outlines several talent-related challenges for mid-sized industrial cities; then, it provides several initiatives and policies from the four case cities. The report ends with a set of ten tips to improve the urban & regional industry 4.0 talent ecosystem.

CHALLENGES FOR INDUSTRY 4.0 TALENT ECOSYSTEMS IN MEDIUM SIZED INDUSTRIAL CITIES

Medium sized cities in Europe face the following challenges regarding their talent ecosystem in Industry 4.0/KIBS:

Labour shortages. Many European industrial cities – including the ones in our network – face substantial labour market shortages and mismatches. The development towards Industry 4.0 goes hand in hand with a growing demand for skilled workers with a medium to higher level of education. New automation and AI technologies may replace staff with machines, but still many people are needed to work with these technologies. Shortages are especially pressing in blue collar jobs that require strong handcraft skills such as laser cutting or welding, and of higher educated professionals in the field of ICT and engineering.

The city of Tartu reports a specific lack of people with skills in lean, industrial engineering, mechanics, operating machines, and ICT systems development, analysis, management, etc. The lack of skilled personnel puts a break on the digitalization of the industry, especially among SMEs that face even more difficulty to attract talent.

¹ Organised by the City Tartu, 28-29 October 2021

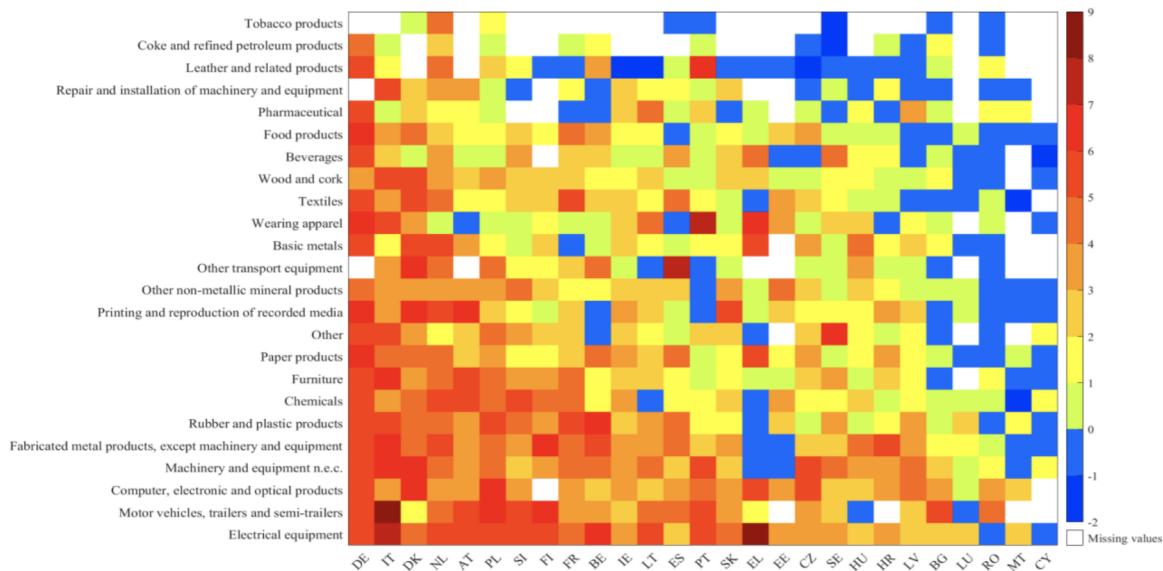


Figure 1 Heatmap of shortages in manufacturing in Europe based on the October 2021 Business and Consumer Survey

Note: Colour corresponds to the severity of shortages as proxied by the number of standard deviations by which the percent of positive responses (to the BCS question on shortages in October 2021) exceeds respective historical averages.

Source: [Business and Consumer Survey](#)

Competition from larger cities. In the race to attract scarce human resources, medium sized cities face competition from larger cities that have a strong attraction force on (young) people. BB, a medium-sized city of 172,000 inhabitants in Southern Poland, reports strong competition from nearby large and more vibrant cities such as Cracow and Katowice, but also from Warsaw and other large cities in Poland that are attractive for students and young professionals. Likewise, Bilbao feels the heat of Madrid and Barcelona, Tartu from the capital city Tallinn, and Timisoara from Bucharest.

Image problems and gender issues. Manufacturing industries have an image problem as employers. Many (young) people still believe that working in manufacturing means dirty, hard monotonous work, long hours, and low pay, even though most manufacturing firms pay above-average wages and work has changed fundamentally in the last decades. Manufacturing is not the number one industry on the wish list of young people to work in, and even more so among girls and young women. The percentage of girls and women in STEM subjects and manufacturing jobs is still very low. In the USA, 73% of teens have little enthusiasm or are ambivalent for careers in manufacturing².

A low societal appreciation of vocational education and manual work. The manufacturing sector pays a price for the low societal appreciation of manual work and firms find it hard to fill well-paid vacancies for which crafts and skills are needed. Over the last decades, and strongly pushed by governments on all levels, the university degree has become the societal norm for many people, and lower or even medium levels of education are considered inferior. Many students choose study fields for which there is little demand in the labour market. In Tartu we

² [How to Reboot Manufacturing for the TikTok Generation](#)

heard cases where university graduates could not find a job and came back to vocational school to learn practical skills.

Shortage of skilled teaching staff. Educational institutes (on all levels) face the pressure to catch up with the needs of the industry. Several cities in the AS-FABRIK network report a shortage of qualified teaching staff, especially in fields that are much in demand (STEM, engineering, technical jobs). Wages in education tend to be lower than in industry and the career perspective is limited, so it is hard to attract and retain talented staff in the educational sector.

In Timisoara, the universities struggle to retain research and teaching talent after the PhD stage, the best ones often leave for the industry that offers higher wages and a better career perspective. The irony is that many (international) businesses locate in Timisoara for the abundance of talent. But to keep the talent flowing in, the university must be able to hire good staff and stay attractive for new generations.

In Tartu, vocational education has a problem to keep up with speed of industry. The teaching corps is ageing, salaries are low, it is difficult to hire new teachers, the image of teaching is moderate, there are limited means to provide extra practical training for teaching staff. Dual careers (where people work both in industry and in education) are largely absent.

Theoretical curricula. Several case cities report a mismatch between the educational offer and the competences asked by employers. In BB and Timisoara, academic curricula are largely theoretical, there are limited opportunities for students to obtain practice-based training (and for firms to collaborate in a structured way with the university). In Timisoara, the official university curricula lack practical activities, real-life cases and internships. Companies, that need skilled staff, hack the system by hiring talented students for part time jobs, that function as unofficial internships. There are still many bureaucratic hurdles to overcome and allow for more dual courses combining classroom learning with internships and on-the-job learning. In BB, despite positive signs and a new pro-active rector, the university still has a long way to go to come closer to business needs. Curricula are largely theoretical, there are still few opportunities for students to obtain practice-based training (and for firms to collaborate in a structured way with the university). There are many bureaucratic hurdles to overcome and allow for more dual courses combining classroom learning with internships and on-the-job learning.

Lifelong learning. A final challenge for cities is to deal with the growing need for lifelong learning and training that comes with industrial transformation and digitalisation. Most cities have programmes in place but they tend to be relatively small and fragmented. Better conditions are needed for the development of the competence of the employees of the companies operating in the city and region.

POLICIES AND INITIATIVES FROM THE AS-TRANSFER NETWORK

The list of challenges is long, but who should address them? Even though the talent ecosystem is crucial for urban and regional economic prosperity, the influence of city governments is limited. Educational curricula are defined by educational institutes, that are often restrained by national regulation. Most funding schemes for economic development or digitalization operate on a national level (about 90% in the case of Estonia), the city and region have limited competence and resources in these fields.

Most industrial companies in our case cities are currently not taking the lead in addressing the skills issues, they see that as prime role for the educational institutes and the (local) government. The latter ones do what they can but more communication between the private sector and the education & public sector is needed to reach more effective and efficient policies and solutions. Nevertheless, our case cities set up many joint initiatives to improve the talent ecosystem.

Initiatives by cities and regional authorities

As part of the **AS-FABRIK project**, Bilbao in collaboration with Mondragon University set up training programmes for university students, entrepreneurs, professionals and city staff, designed to tackle the challenges of industry 4.0 in the digital economy. It included the following elements:

- Technical training programmes for professionals working in industry 4.0, about embedded systems, data science, advance service design
- Business trainings for professionals; on servitization, entrepreneurship, new business models
- A new degree in business data analytics, mixing tech and business, plus a 3 year PhD thesis trajectory on Industry 4.0
- Customized training for companies, attended by 50+ professionals; on data science, embedded systems, servitisation
- **Training programmes for policy makers**; 5 training modules on various aspects of Industry 4.0 and advanced services.

In **Timisoara**, the Municipality set up the **Regional Centre for Skills and Supplier Development** in the Automotive Sector (CERC), funded by EU, in 2016. It is a learning by doing and development centre for the automotive industry, located in the Industrial Park of Timisoara. CERC is owned and managed by the city.

The concept of CERC is to bring together automotive industry, training, prototyping, and testing, and to promote joint innovation between companies. CERC runs a training academy, offering courses to companies in the broad field of automotive (quality management, CNC machinery handling, process management), at the request of companies; courses are provided by external lecturers from universities and from practice. CERC also has technical equipment that might be used on a pay-per-use basis by companies, such as drills, pipe axes, measuring devices, and a plastic injector.

The facility is specialised in facilities for plastic moulding, a strong point of the region. Moulding requires specific skills and competences, as well as specific prototyping equipment. Large companies tend to have this in-house, but smaller ones don't. CERC also rents out business space: Continental, the large automotive supplier, is one of the tenants. Regarding prototyping, CERC has machinery for plastic injection, that is rented out by the hour; small firms get a lower rate than big ones.

The **city of Tartu** takes an active role to develop various aspects of the talent ecosystem. To change the image of manufacturing, it helps schools to organize field trips to manufacturing companies, so that pupils learn more about how it is to work in industry. This is done as a collaboration between the economic and education departments of the city; the city helps to merge groups from different schools and channel them to the right companies of interest.

Furthermore, the city helps the Tartu Vocational Education Centre (which is 100% owned by the city) to develop programmes for more on-the-job learning and to train the trainers at companies. Economic development staff conducted 1 on 1 interviews with many industrial companies, to understand their needs, and to help overcome barriers to take up more trainees and support their staff to supervise pupils.

Tartu's Business advisory centre (governed by state and part of County Development Centres) gives out financial support and services for companies, with a focus on smart industry. One example is lean manufacturing workshops (6 courses in 9-10 weeks, after which you receive a certificate), where firms learn to map and reorganise their processes according to the "lean" philosophy, before implementing digital solutions. 22 firms took the course in 2019-2020. 50% of costs are subsidized, the rest (250-300€) is paid by the participating company.

Initiatives by educational institutes

Internships and placements are key to forge the link between business and education. While internships are usually undertaken over the summer months or after graduation to gain experience in a particular field, work placements are taken as part of a degree. Students on a placement year are completing a module and receive academic credit for the year. Here are some examples related to industry 4.0:

- [Germany : new nationwide training concept for Industry 4.0](#)
- [National Apprenticeship Week : The Challenges in Education and Training for Industry 4.0](#)
- [Advanced Apprenticeships \(Industry 4.0\) pilot](#)
- [Systems Engineering \(Industry 4.0 Focus\) Placement Summer 2022 start](#)

Tartu Vocational Education Centre is a municipal vocational school, funded by Tartu City Government. Hence, the city has some degree of influence on the school's policy and its curricula, and stimulates initiatives that improve the urban talent ecosystem. The vocational school has been working closely with some of Tartu's manufacturing companies in developing the work-based-learning system to make the graduates better equipped for the actual needs of the labour market. In a project, TVEC sends teachers to companies to do "job shadowing" so they see what is going on in practice; However, there is no permanent funding for this activity.

The University of Tartu has many interfaces with Industry 4.0. Its Institute of Computer Science has a range of activities to connect with companies. It offers 9 different courses – all related to computer science, engineering, data science, IT, cyber security, cloud computing etc. It offers a 'service portfolio' – a wide range of collaboration options – from collaborative R&D at one end of the spectrum to simple career days, and data science seminars. In the middle are sandbox, student internships etc.

Also they have an Industrial Masters in IT – which does require some commitment from the business – it's a 13-month talent accelerator bringing together companies & students. 1st & 2nd semesters are taken at university – then in the 3rd & 4th semester they join the company & still take a few courses at the university. This is done through an internship mechanism. At the end the students write their master's thesis- and this will be connected to something that is important to the host company. Companies pay.

Until 2020 it was mostly tech companies that were involved, but in 2021 they have piloted in manufacturing industry. Students help firms to optimise their manufacturing processes. There is a lot of potential here to support manufacturing – software engineering, data science, machine learning, business analysis, predictive maintenance, automation of accounting / finances. Another example is the Conversion Master in IT, in which employees without ICT background get an IT training.

The **Politechnical University of Timisoara** provides specific training in the context of Industry 4.0 - Master programmes in Mechatronic and Robotic and Artificially Intelligent Robotic Systems, Applied Informatics Systems in Production or Services or Automotive Embedded Software. Also, a new research centre is in the making, co-designed with the industry, focusing on data engineering and industry. It will have 4 pillars: AI (especially applied to autonomous driving and retail); cloud computing & IoT; Cybersecurity, and smart systems & robotics (especially in industry and medical applications). An application is made for EU funding, and the centre is planned to start in 2024. The Board will be a public-private mix.

TEN TIPS FOR A BETTER TALENT ECOSYSTEM

Based on the challenges and initiatives above and discussions during the workshop, we suggest a list of ten tips to improve the talent ecosystem:

1. Bring young people in contact with manufacturing, through company visits or experience centres³.
2. Show that manufacturing is nowadays more about technology and communication than about dirty and hard manual work.
3. Underline the massive challenge of “greening” manufacturing industries. Many young people are motivated to address environmental and climate issues, and the manufacturing sector is one where they can make a big difference.
4. Encourage or facilitate the development of dual learning or practice-based learning, on all educational levels.
5. Offer facilities for life-long learning where employees can develop themselves, and encourage employees to do this. It will increase productivity and reduce outflow.
6. Set up platforms or touchpoints where educational institutes can collaborate with industrial companies to develop on-the-job training (as done in Tartu) or research & innovation programmes.
7. Develop opportunities for dual careers, where professionals can work both in industry and in education.
8. Take action to increase the share of underrepresented groups such as women, ethnic minorities and disabled people in STEM education and industrial workforce. Develop an educational strategy to alter some deeply culturally embedded ideas and perceptions that manufacturing is for boys.
9. Develop training programmes for policymakers and politicians to increase their understanding of industry 4.0 developments and implications for their city (as Bilbao did in AS-FABRIK); this will pay off in the form of better-informed policies.
10. Take a regional perspective in any talent ecosystem initiative, because many manufacturing firms are not located in the city but in the surrounding region, falling under different jurisdictions.

³ Rotterdam has a Harbour Experience Centre, where school classes (but also other people) can experience the port and gain a better understanding what it is like to work in the port related industry.