Skills Data Playbook

How can skills data help solve challenges related to skills and competences?

CONTENTS

Foreword

The transformation of working life is gaining more and more momentum and speed. The climate crisis, the Covid-19 pandemic and the war in Ukraine have led us to make giant strides in developing the skills required for digitalisation and the green transition – and they have greatly increased the need for such skills. At the same time, our demographic change and people retiring at an accelerating rate are challenging the whole education system and working life.

In spring 2020, Technology Industries of Finland started to construct a new study on what kind of expertise technology industry companies would need. We did not settle for a traditional survey but we decided to harness technology in our assistance to anticipate needs for experts and skills. This gave rise to a series of experiments based on skills data.

Bold new initiatives must be taken to anticipate skills requirements. By making better use of the information available on competence and skills needs in society, we can develop anticipation of skills needs based on modern data analysis over different time horizons.

When repeated regularly, data-based anticipation of skills needs will provide us with a picture of the situation that is much more up to date than that produced using the current methods, showing us what kind of expertise is needed in a particular industry or geographical area at any given time.

Skills data can act as a "medium" between different actors.
- Better matches are found between experts and jobs.
- Learners can find right kind of learning opportunities and educational offerings.
- Training can better meet the anticipated competence needs.
- Society can allocate its resources to the right place.
- Companies are better able to develop their competence and talents.

These observations gave rise to the Skills Data Playbook, which brings together our thoughts on competence data, competence policy and the experiments we have conducted around them with our partners. Technology Industries of Finland and its partners want to make these findings available to society.

Helsinki, 29 April 2022

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Chairman of the Technology industries and services foresight group in
the National Forum for Skills Anticipation, Finnish National Agency for Education 2019–

Role of skills data in promoting skills policy

Technology Industries of Finland, we aim to shift the debate from shortage of talents to expert solutions. We see using skills data as a promising new direction in which to seek such solutions.

Data is rarely the main topic in skills policy discussions. Therefore, in this series of articles, we have now compiled practical examples of how to use skills data. We hope that it would be given a greater role as one of skills policy tools.

What skills data?

Skills data describes people's skills, the competence needs of organisations and the competence offerings of educational institutions. In practice, skills data can be found, for example, on employees' CVs, companies' job adverts and course guides.

At its best, skills data could be a unifying factor that helps different actors steer their operations in a direction that would raise and develop the competence level of the whole of Finland at a rapid pace.

Having a shared understanding of skill data helps, for example, education providers and companies communicate flexibly about skill needs when creating new training offerings. Similarly, skills data provides each of us with data-based tools to support our own competence development.

Skills data is generated and processed in various systems, such as learning platforms, HR systems, recruitment systems, course trays, LinkedIn and CV banks. Today, these systems do not yet "talk to each other": they do not understand the data produced by other systems, and it is difficult to transfer data between them. However, these interoperability issues are already being addressed, for example, in the Skills data space project funded by the European Commission.

Using advanced artificial intelligence algorithms, indications of competences, interests and competence needs can be mined from a wide variety of data sources, such as open research publications, in-house databases or, on a personal level, from our own browsing history, for example. Artificial intelligence and data analysis are good support functions for verbally expressing current and future skills needs.

People

Job seeking
and recruitment
Experts and
jobs meet

Learning
opportunities
Learners find learning
opportunities

Skills Data
ecosystems

Organizations

Education
providers

Developing
training
provision
Education meets
anticipated skills needs
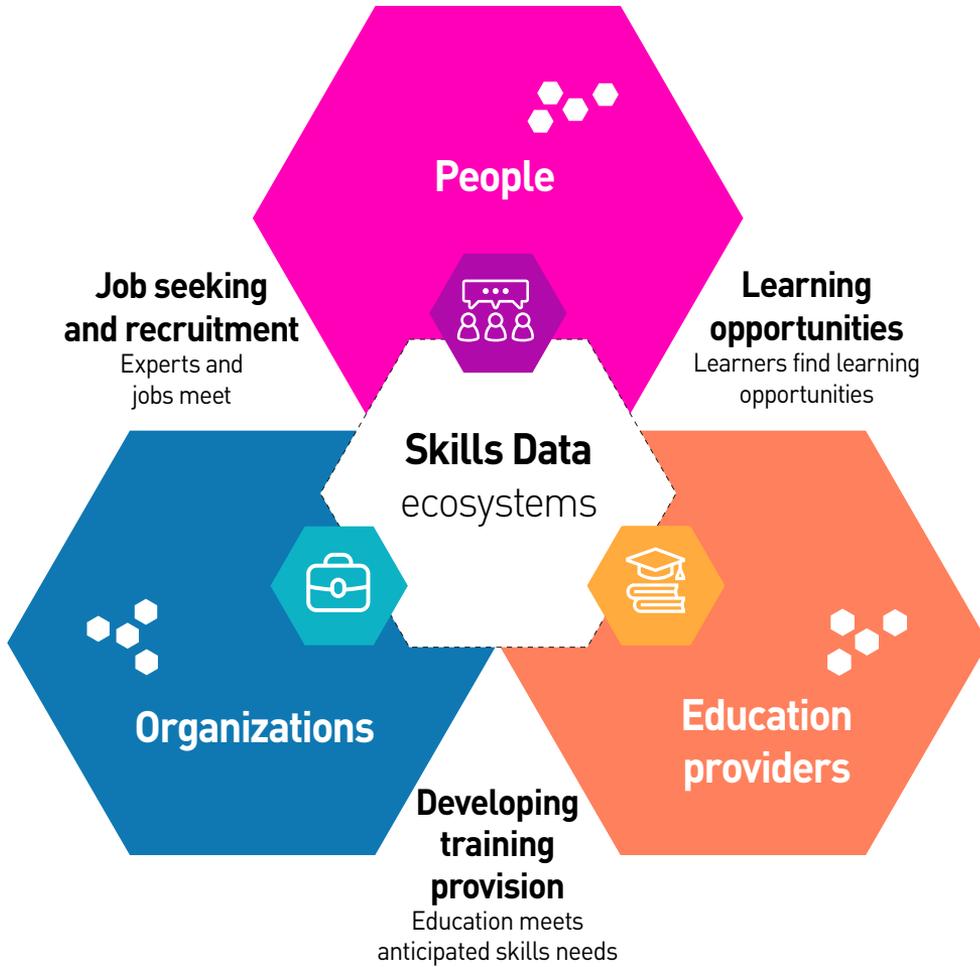
What skills policy?

Skills policy is a range of tools for increasing the level of competence in society as a whole, guiding the development of competences to meet future needs and enabling the generation of new innovations.

Traditionally, it has been referred to as education policy (principles and guidelines governing education) and labour market policy (e.g., promoting employment and labour mobility). As the pace of change in working life and competence needs keeps accelerating, the focus should be shifted to a broader skills policy, acknowledging that learning does not end at completing a degree and competence development is the best way to promote employment. In working life, competence

The education system and immigration leading to work generate more high-quality competence

Finnish know-how in technology attracts companies, talent and investments

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world-class
**and devel
expe**

Companies create **innovations through expertise**

Competence management is **part of** companies' **strategy** and they investin the ability to renew

Work cultures foster learning, creativity and diversity

Everyone takes **responsibility for their own competence**

is measured not only by degrees earned, but also by experience, demonstrations of competence and the desire to learn.

We develop our skills throughout life, and that is a good thing, because in a changing world the expiration date of our current skills is coming up faster and faster. Organisations also learn new things, and in society skills spread when people and organisations collaborate with each other.

According to the [study on the need for skills](#) conducted by Technology Industries of Finland in 2021, Finland's technology industries will need 130,000 new experts at a rate of about 13,300 every year in the next 10 years. To overcome this challenge, Technology Industries of Finland identified in its skills policies the following as key solutions: the availability of competence, work cultures as places for competence development and the spread of competence in society.

Continuous learning responds to the needs of companies **flexibly, easily and proactively**

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availability
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Cross-border networks strengthen the capabilities and competitiveness of companies

Know-how spreads effectively in society

Finland is a **world leader in research, development and innovation**

New ways of working allow companies to renew

Skills data to assistance when solving skills policy challenges

The use of skills data is not a separate skills policy objective, but a means of contributing to the achievement of many other interrelated objectives. Below, we have outlined some opportunities for using skills data to promote Technology Industries of Finland's skills policies.

⬡ **The objective is world-class availability and development of expertise**

Anticipating skills needs → Data can be used to identify and anticipate organisations' competence needs in a more real-time and accurate manner *(see Case 1: Skills Pulse – anticipating competence needs in the technology industry)*.

Education system → Competence needs in working life can be better taken into account when developing educational contents *(see Case 3: Artificial intelligence and skills data as a basis for foresight dialogue when developing education)*.

Migration leading to employment → Reliable skills data on, for example, foreign degrees, facilitates the identification and recognition of skills acquired abroad.

Continuous learning → The organisations' competence needs make it possible to target the offering of continuous learning services and make them easy to find; thus working life will reform education and training, and education and training will reform working life.

Matching → Guidance services; people can identify potential competence paths.

Finland attracts companies and investments → Regional analysis of the availability of skills and making concentrations of skills visible support companies in deciding where to locate their operations.

⬡ **Know-how spreads efficiently in society**

Spreading → The networked education system is strengthened and higher education can be organised across traditional borders; educational institutions can find partnerships for providing different study entities.

New ways of working → Platform-mediated work requires demonstration of competence, and at the same time platforms enable the accumulation of skills data.

Cross-border networks → Data describing the skills and competence needs of companies may help in finding suitable partners for innovation projects domestically and internationally.

Strategic competence development → Skills data can be used to assess whether a company has the skills required by its strategy and when making decisions related to matters such as recruitment, personnel competence development, reorganisation of tasks or outsourcing. *(see Case 2: Skills data accelerator – data to assistance in strategical management of competence in companies)*

Everyone takes responsibility for their own competence → Using their own skills data and data describing jobs and educational offerings, people can find opportunities for themselves through various digital services. *(see Case 4: FutureProof – A gamified matching solution for individual employees)*
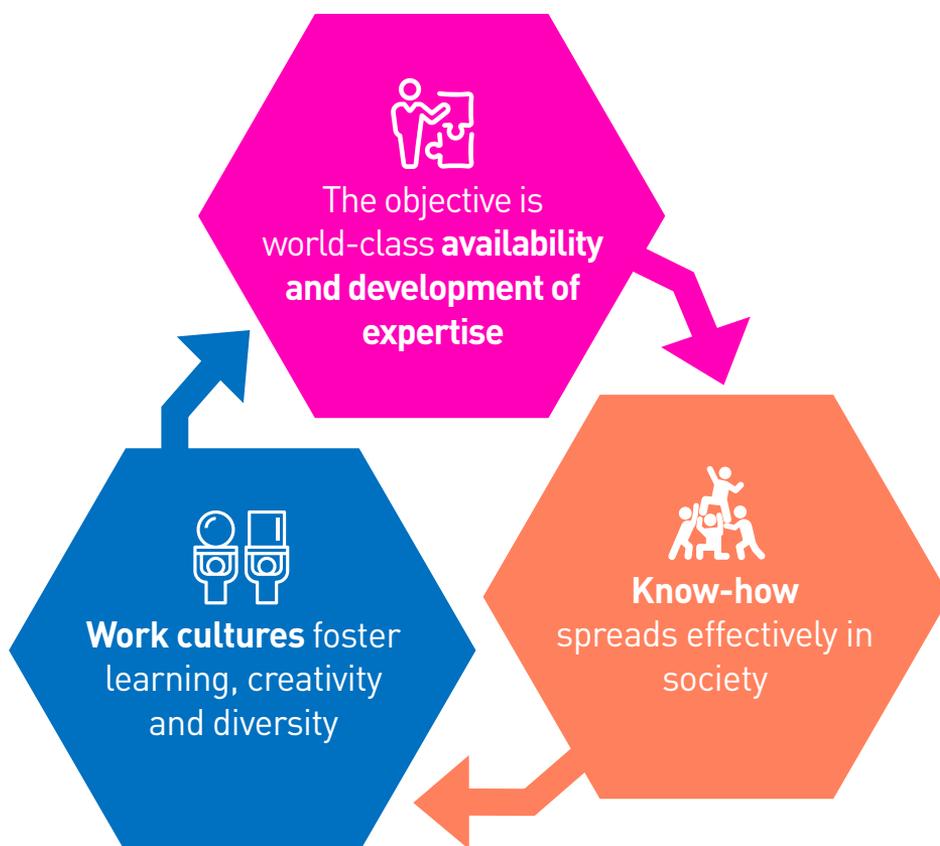
The objective is world-class **availability and development of expertise**

Know-how spreads effectively in society

Work cultures foster learning, creativity and diversity

Skills Pulse – anticipating competence needs in the technology industry
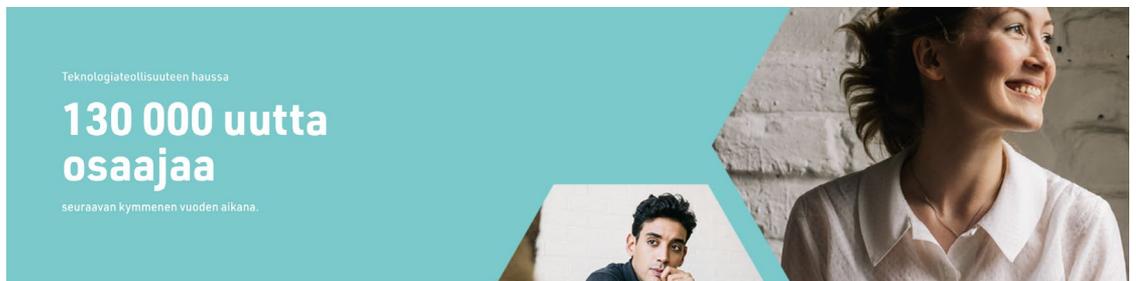
The aim of the Technology Industries of Finland's Skills Pulse (2021) was to explore the competence needs in technology industry sectors more extensively than before, using AI and skills data.

In the first phase, Headai's artificial intelligence was used to identify what kind of skills have been highlighted in the public job adverts of Technology Industries of Finland's member companies in recent years and what kind of connections can be found between the competence needs. This enabled finding the main competence themes and related skills sought in job adverts for each of the five main industries.

Based on this, more than 300 member companies joined an online workshop to assess how important the identified skills will be to their business in the coming years. The respondents also supplemented the information generated by artificial intelligence and explained why a particular skill is important to their company.

The understanding of the competence needs companies assessed as being most important was further deepened by using artificial intelligence to find related skills in openly available applied research publications, Business Finland's project descriptions and the theses made in universities of applied sciences.

The results were compiled on the Skills Pulse website for everyone to use.

Lessons learned from the experiment:

Artificial intelligence makes it possible to identify a very wide range of skills from different source materials: what matters is the process by which the skills data is processed into usable information.

When running projects that produce skills data, the starting point should be who uses the data as well as in what kind of situations and for what kind of purposes they would use the data.

One must understand the nature of the data sources and the limitations deriving from them – what kind of skills are displayed in recruitment adverts, for example, and what kind of skills are not recorded in them.

When analysing skills data, it is advisable to allow plenty of time for expert work and to involve the key stakeholders extensively in interpreting the data.

Benefits of skills data:

For education policy makers, the Skills Pulse data provides a view of the most important competence needs in the field.

Education providers can use the knowledge data when doing curriculum work or planning the provision of continuous learning.

Companies can use the information to compare their own company's needs with the general development in the industry.

Young people making educational decisions and employees developing their skills can seek support for their decisions from the anticipation data.

IDEAS FOR THE FUTURE

Continuous learning services are currently undergoing a reform. As this work is aimed at bringing anticipation information and training provision better together, data describing the competence needs of various industries could act as a unifying factor.

COMING SOON: Next, we will examine how data can be used to identify stronger signals about competence needs. What kind of skills are starting to appear more often in job adverts? What about in research publications? Such information would serve the needs of medium-term anticipation, which has often proved difficult, and, in particular, the development of curricula for degree programmes.

Skills data accelerator – data to assistance in strategical management of competence in companies

Competence strategy

- Upskill people
- Hire people
- Retain people
- Lose people
- Reorganise teams and jobs
- Outsource
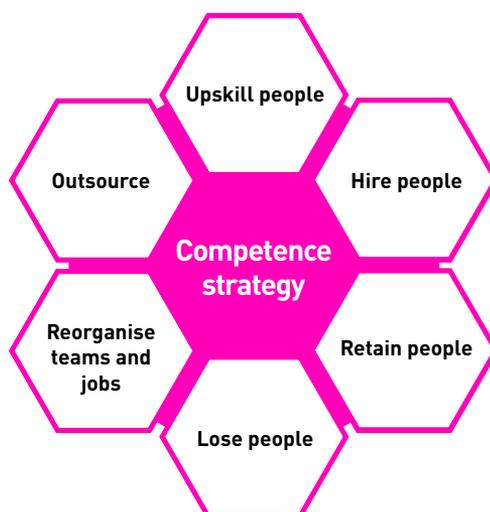
Companies have already harnessed data and analytics for a wide variety of functions, from customer service to production control. HR functions have not been at the forefront of using artificial intelligence, but there is growing interest in the opportunities offered by data for managing and developing competence.

What does it look like when a company's strategic competence is managed using data? Technology Industries of Finland studied the question in a skills data accelerator in collaboration with pilot companies Wärtsilä, ABB and Konecranes. The accelerator examined in what kind of competence management issues data and analytics are most helpful, what kind of data is available and what kind of data would be needed. The accelerator's technology partner was Headai, whose analytics tools were utilized by the companies involved.

The starting point for using skills data were the key business needs of companies. They were mapped by establishing the current state of the company's capabilities and their desired future state as well as by identifying ways to reach the target state.

Decisions related to managing the company's competence are roughly related to the continuous learning of personnel, recruitment, outsourcing, the organisation of personnel and operations, the goal to retain key talents, and anticipating staff turnover. In data-assisted competence management, data collected from different sources is applied to making these decisions.

Lessons learned from the experiment:

The use of skills data should start from business needs – the accelerator identified six key areas of issues as starting points for the data-assisted competence management strategy.

With a view to dealing with issues stemming from business operations, the availability of usable skills data may be poor. When it has been identified what kind of skills data is needed, the collection of data can be developed in connection with developing other systems.

Artificial intelligence and data are of great assistance in HR functions, but any interpretations are made and conclusions drawn by people.

Benefits of skills data:

Data makes it possible to improve the organisation's understanding and situational awareness of competences and competence needs.

Public data sources, such as recruitment adverts, make it possible to analyse the industry and to make comparisons with competitors as well (what kind of competence are others looking for).

The assistance provided by data can be used for validating the understanding obtained in other ways, but the greatest potential may lie in detecting signals that easily remain hidden when using traditional means.

IDEAS FOR THE FUTURE:

- It is advisable to start any measures to introduce data-assisted competence management lightly, without major system integrations, first identifying the issues that are important for your business operations. Once identified, these needs can be used to guide the collection of skills data in a goal-oriented manner in the longer term.

Skills data as a basis for foresight dialogue when developing education
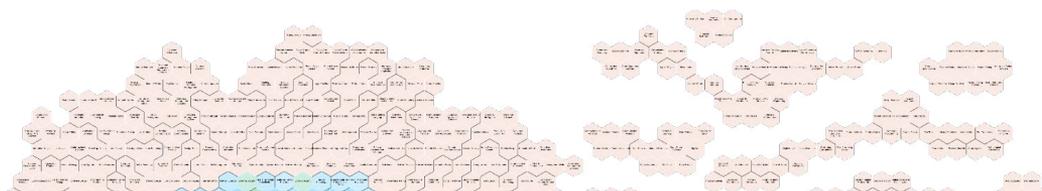
The universities of applied sciences are tasked with providing education for professional expert tasks that is based on the requirements of working life and its development. Their activities highlight their connection to working life and regional development.

Curricula evolve with everyday life and are tools for dynamic guidance that develop as the operating environment changes. New, data-driven solutions are needed to anticipate competence needs and develop education in order to meet constantly changing working life and regional needs. The different time spans of anticipation serve different tasks and functions.
- o long term - strategic development and RDI activities
- o medium term - development of curriculum work
- o short term - continuous development of own teaching, development of modular course offerings and continuous learning provision

The cooperation project between Metropolia University of Applied Sciences, Technology Industries of Finland and Headai utilised artificial intelligence and the workshops of teachers and lecturers for analysing and developing Metropolia's curricula. Using skills maps created by artificial intelligence, the workshops examined how well Metropolia's curricula respond to the identified future competence needs in selected degree programmes.

The analysis utilised Technology Industries of Finland's Skills Pulse solution, the extensive competence needs analyses made for it using, for example, job adverts and research publications, and machine-read Metropolia curricula. Headai used its artificial intelligence solution to make comparisons between the two data sources. The comparisons produced skills maps that describe the similarities and differences between competence needs and curriculum contents. The workshop with teachers and coordinators of education examined how Metropolia could in the future use the information provided by the Skills Pulse and skills maps to develop curricula and training offerings for continuous learning.

Lessons learned from the experiment:

The Skills Pulse closely describes the skills needed in the labour market and serves the needs of anticipation information for higher education institutions. Its skills maps provide an opportunity for deeper background processing, the examination of interdependencies and similarities.

There are extensive opportunities for using data-based anticipation data in the higher education field. There is not only one solution, but different uses for different target groups (teaching developers, providers of continuous learning services, teachers and RDI activities).

It is essential to link data-driven development into processes and operations, to identify the right time and support for using data (data literacy, data strategy). New modes of operation will be developed through experiments.

Benefits of skills data:

Foresight information, skills maps and mechanical analysis of competence needs can be utilised for the purposes of knowledge management, curriculum work and the development of course offerings. It helps answer questions such as: What kind of skills are needed in working life? What kind of expertise does the higher education institution provide?

Skills data enables creating a dynamic situational picture of competence needs and can be used to automate the examination of new themes in the process of reforming teaching.

Skills data relates in particular to the development of continuous learning services in higher education institutions. It is one tool for agile needs analysis and service development. It can be used for determining, for example, what is in demand right now and how much of it is needed by analysing such factors as dominant and emerging technologies, tools used in enterprises and working methods.

IDEAS FOR THE FUTURE (AND A PROPOSAL FOR DECISION-MAKERS)

- Skills data serves in particular the dynamic development of a higher education institution's curriculum process, teaching and continuous learning.
- Skills data can be used for the purpose of national guidance of higher education institutions.
- Another area of application we identified: Utilising skills data as a basis for dialogue with higher education institutions, companies and partners and for strategic development of teachers' competences.

FutureProof –
A gamified matching solution for individual employees
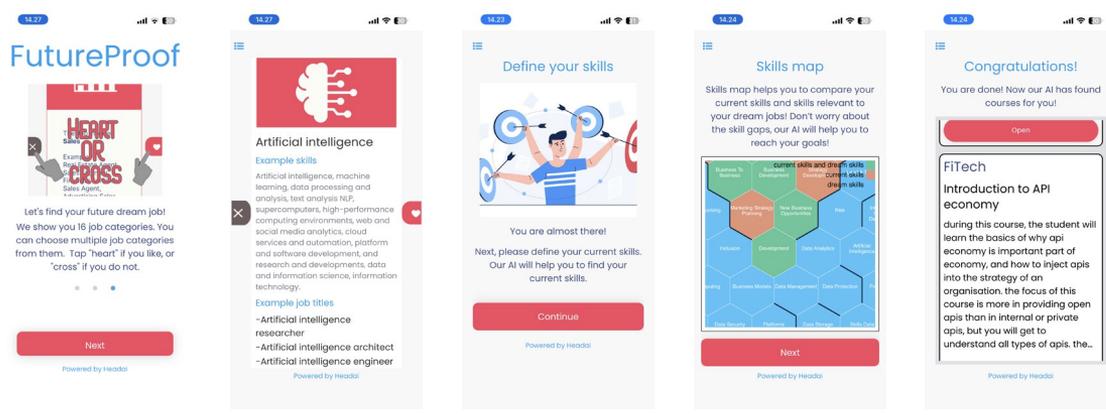
Case 3 motivated us to take the next step with Headai and create a mobile application called FutureProof. The app enables individuals to identify their ideal roles in the technology industry, describe their current skill set, and determine the skills they need to develop to achieve their dream roles. The application also suggests relevant courses for upskilling.

The application starts by asking users about their interests. Based on their choices, the app shows them job ads related to those themes, allowing them to like or reject them. This process helps to identify their dream roles. Next, the user's current skill set is mapped based on their present job. Finally, the application generates a skills map that visualises the intersection of the user's interest profile and their current skills. Based on any identified skill gaps, the app recommends courses from the FiTech Network University.

Lessons learned from the experiment:

Using AI to analyze job advertisements can improve the identification of an individual's existing skills and identify the necessary skills required for their desired job positions.

By incorporating skills data, applications can offer personalised support to encourage continuous learning, helping individuals in their career progression.

In addition to individuals, career counselors should also be included in the target groups for application development.

Benefits of skills data:

Utilising skills data for technology jobs allows individuals to be presented with job ads relevant to their areas of interest.

Skills data makes it easy to compare an individual's current skills with the skills required for their desired jobs.

By combining skills development needs with information on training content, the data can be used to recommend the most suitable training pathways.

IDEAS FOR THE FUTURE:

- The successful implementation of applications for individuals and career guidance providers requires careful consideration of the user experience of different user groups.
- Skills data from various sources, such as study registers or CVs, could also be used to identify an individual's skills. This requires open APIs for the data and easy ways for individuals to allow the transfer of their data to applications.

Skills Pulse Signals –
identifying trends
in skills needs

Trends in Hydrogen - DOAJ

Year ● 2018 ● 2019 ● 2020 ● 2021 ● 2022 ● 2023
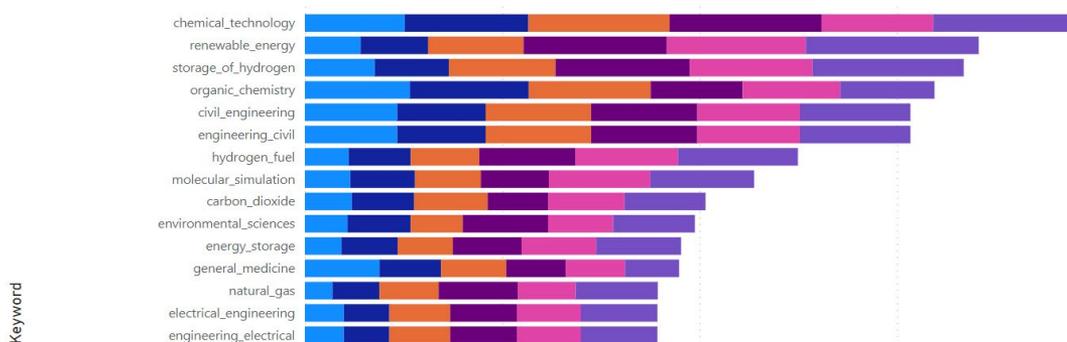
In the follow-up phase of the skills pulse (Case 1), Headai's technology was used to examine changes in skills requirements related to selected themes from research publications and job advertisements in the mechanical engineering industry.

Regarding research publications, those containing the keywords "decarbonisation," "digitalisation," or "hydrogen" were analysed. Similarly, for job advertisements, those mentioning digitalisation, energy or sustainability either in English or in Finnish were selected.

The skills data was used to produce a visualisation that displayed either the primary skills needed for a particular year or the alterations in skills requirements between the chosen years. This allowed for the identification of both trends in key competencies and changes in the individual skills associated with them. Additionally, the ChatGPT service was tested for preliminary interpretation and summarisation of the outcomes.

Lessons learned from the experiment:

Change maps can provide a quick and concise visual summary that facilitates the identification of the primary trend - whether the skills requirements associated with a particular theme are increasing or decreasing.

Relying solely on a keyword-based approach to define data runs the risk of excluding a significant amount of information that individuals would intuitively associate with these themes. For example, even if a programmer's job is related to digitalisation, a job advertisement for a programmer may not include the term "digitalisation."

As the analysis techniques for skills data become more intricate, it becomes increasingly critical to have a shared understanding of the advantages and limitations of the approach.

Benefits of skills data:

AI-generated skills data assists in condensing extensive data sets, making them easier to analyse.

Skills data facilitates comparisons of skills requirement trends across various sources.

Skills data can be utilised as input for further AI analysis of skills requirements.

With this experiment, we were able to take a glimpse into future skills needs as well, as we saw which competencies would emerge on the maps if the trends continue in the same manner in the future.

IDEAS FOR THE FUTURE:

- To enhance the usability of knowledge data, the next step would be to shift from a keyword-based analysis to a thematic analysis. This approach would eliminate the need for users to have prior knowledge of the most relevant keywords.
- With the assistance of AI, we can not only identify trends in individual competencies but also automatically recognize broader emerging areas of competence.

Vocational Pulse –
Data-driven development
of vocational education

The key objective of vocational education and training is to develop students' skills to meet the needs of working life. The Vocational Pulse pilot explored data-driven solutions to ensure a match between skills needs and training provision. The pilot was conducted in collaboration with VET teachers, planners, and representatives from the world of work.

The pilot compared the requirements for vocational degrees in mechanical and production engineering and ICT with the skills needs identified by AI from job advertisements in the same industries. Workshops were conducted to examine the analysis generated by AI regarding the alignment of skills needs and supply. The objective was to produce more precise information on the skills mismatch by exploiting the potential of AI. The workshops also discussed foresight from both short- and long-term perspectives.

The data analysis and simulation produced by AI enhanced the analysis and opened up new perspectives on the match. In the short term, the data can be used to develop local qualifications, and in the longer term, changes in skills requirements and new skills can be identified for inclusion in national-level requirements.

Lessons learned from the experiment:

In principle, the vocational requirements are good, but the terminology used differs from the labour market vocabulary.

Vocational education and training in engineering involves a significant amount of learning about various tools and technologies. The more detailed the source materials are in describing these, the more useful the information generated by data analysis will be for the development of teaching.

There are differences between sectors in the source material. For example, in mechanical and production engineering, both the national requirements and the job advertisements often lack detailed information on the tools and technologies. In the IT sector, job advertisements often provide richer content and more direct information for the development of teaching.

Benefits of skills data:

The data on competences provides tools for the design and development of work-based learning. Data describing the needs of companies can be used to plan which parts of a qualification can be learned in a work-based environment.

A better match between skills and jobs will help tackle the problem of youth unemployment. Data analysis can help identify labour market needs and develop training provision to meet these needs, helping young people gain the skills and competences they need to succeed in the world of work.

IDEAS FOR THE FUTURE:

- Graduates should be supported in expressing their skills using job market vocabulary, and the skills they have gained should be reflected more comprehensively in their certificates.
- The use of more precise data would aid in identifying subtle variations in skills that may impact the compatibility between the skills provided and industry requirements. This can help identify potential issues and improving the alignment of skills with job opportunities.

Notes

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