

Tekoälyn tilanne ja tulevaisuus

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08/09/2025 VTT – beyond the obvious

What is Artificial Intelligence?

- **Artificial intelligence (AI, also machine intelligence, MI)** is Intelligence displayed by machines, in contrast with the **natural intelligence (NI)** displayed by humans and other animals.
- We talk about AI when a machine mimics "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving".

Levels of AI

WEAK, NARROW AI

Very good in recognizing faces in images or playing chess or optimizing a complicated system. Totally useless in everything else.

STRONG, GENERAL AI

AI with broad understanding and human-like consciousness.

Today, *we do not have* Artificial Intelligence in the sense that machines would have consciousness or will of their own. (Someday we may have).

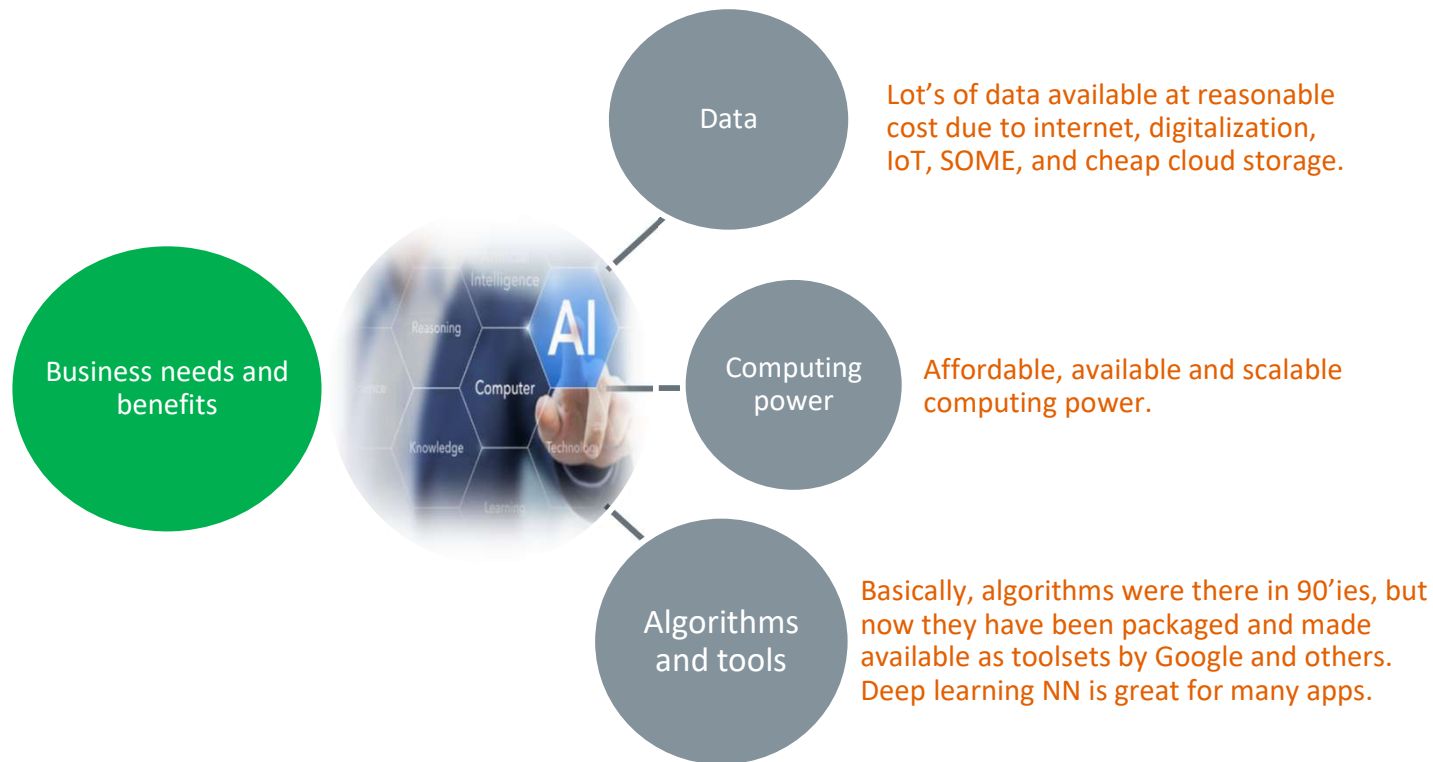
SUPER AI

AI superseding human intellect in all respects. Related to the concept of singularity. Popular in sci-fi.

Problems to be solved with AI

- The traditional problems (or goals) of AI research include reasoning, knowledge, planning, learning, natural language processing, perception and the ability to move and manipulate objects.
- General intelligence is among the field's long-term goals.
- Approaches include statistical methods, computational intelligence, and traditional symbolic AI. Many tools are used in AI, including versions of search and mathematical optimization, neural networks and methods based on statistics, probability and economics.

Why is AI a hot topic now?




AI Agents in Action! 🚀

- **Autonomous Query Handling** 🤖: Our AI agents start by taking user questions and autonomously initiating search queries across the web.
- **Smart Validation** 🔍: They don't just retrieve results; they rigorously validate the top sources, ensuring the accuracy and relevance of the information.
- **Iterative Refinement** 🔄: Through an iterative process, the agents refine their queries, continually improving the quality and depth of the information gathered.
- **Comprehensive Reporting** 📊: The final step is compiling all this validated data into a coherent, insightful report tailored to the user's needs.

input_message

What are the latest trends in AI?



Clear

Submit

AI Agents in Action!

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Here are some of the latest trends in AI for 2023 based on various sources:

1. Generative AI:

- **Explosion of Generative AI:** Tools like OpenAI's DALL-E 2 and ChatGPT have sparked widespread interest and use. These tools can create images, text, and even videos based on text prompts, and their applications are growing rapidly.
- **Multipurpose Chatbots:** Next-generation AI models like GPT-4 are expected to handle more than just language, combining capabilities like image and video recognition.
- **Business Integration:** Companies are increasingly adopting generative AI for tasks in marketing, sales, product development, and customer care.

2. Democratization of AI:

- **Open-Source Revolution:** The availability of open-source AI models is lowering barriers to entry, enabling smaller companies and individuals to innovate. Examples include Hugging Face's BLOOM and Stability AI's Stable Diffusion.
- **Impact on Big Tech:** The rise of open-source AI is challenging the dominance of big tech companies in AI research and innovation.

3. AI Regulation:

- **Government Oversight:** Governments are beginning to implement regulations to manage AI development and use, such as the EU's AI Act and the US's AI Bill of Rights.
- **Ethical and Secure AI:** Increased industry adoption of AI is pushing for more ethical and secure AI products, with an emphasis on transparency and accountability.

4. Explainable AI:

- **Improved Understanding:** There's a growing focus on making AI models more understandable and transparent to mitigate issues like bias and misuse.
- **Regulatory Compliance:** Companies are expected to disclose how AI systems are built and what data they use, driven by regulatory requirements.

5. Human-AI Collaboration:

- **Complementary Roles:** AI is being integrated into workflows to augment human capabilities rather than replace jobs outright. This collaboration is seen in various fields, from customer service to creative industries.
- **Reskilling Workforce:** As AI adoption increases, there's a significant focus on reskilling employees to work alongside AI technologies.

AI Today

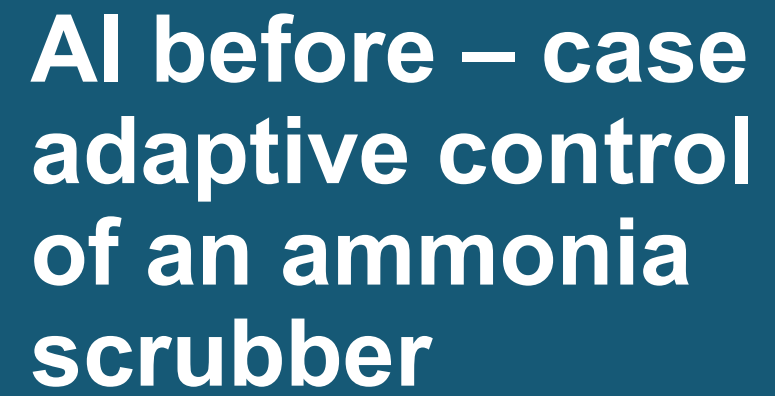
(Expoding Topics, Josh Howarth May 2025)

- The global AI market is valued at approximately \$391 billion.
- The AI industry is projected to increase in value by around 5x over the next 5 years.
- The AI market is expanding at a CAGR of 35.9%.
- As of 2025, as many as 97 million people will work in the AI space.
- 83% of companies claim that AI is a top priority in their business plans.
- Netflix makes \$1 billion annually from automated personalized recommendations.
- 48% of businesses use some form of AI to utilize big data effectively.
- 38% of medical providers use computers as part of their diagnosis.

AI gross value added (GVA) in 2035

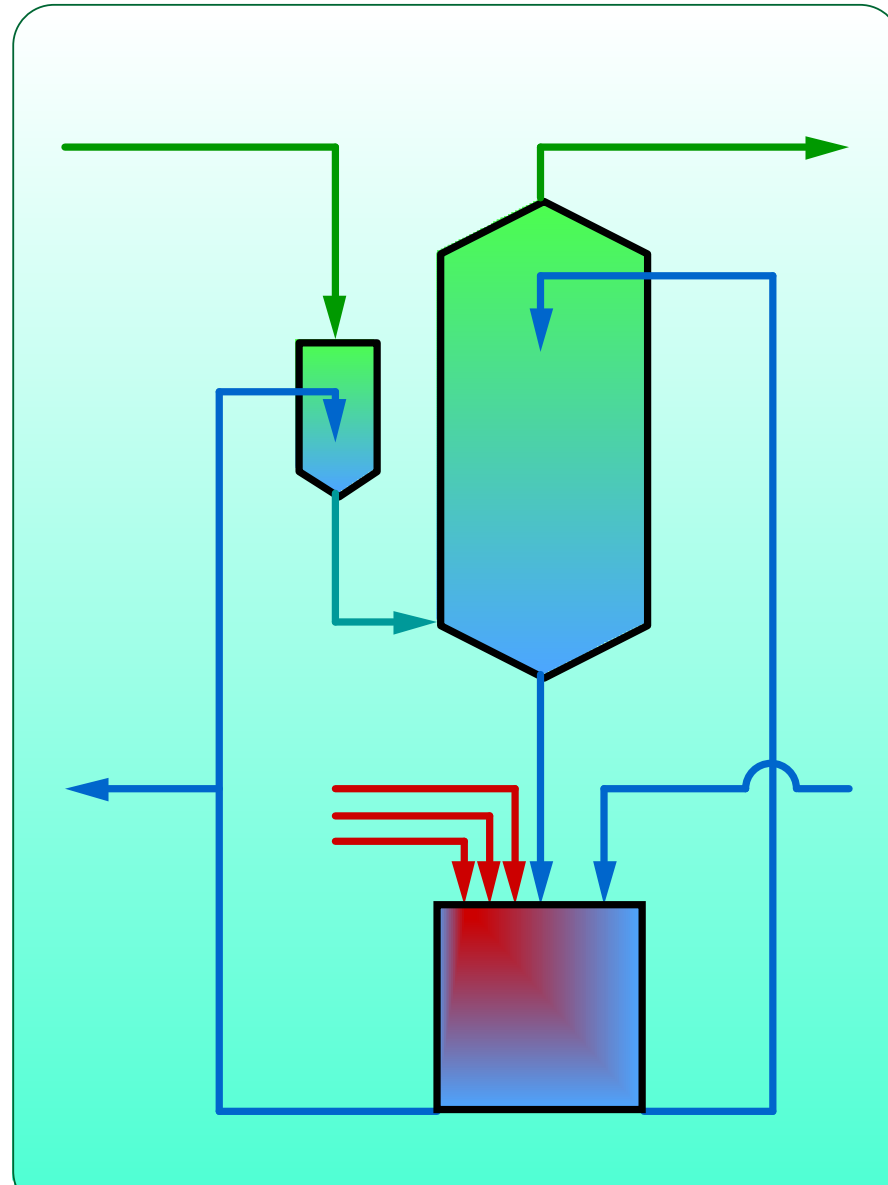


Accenture, 2025



Ammonia scrubber

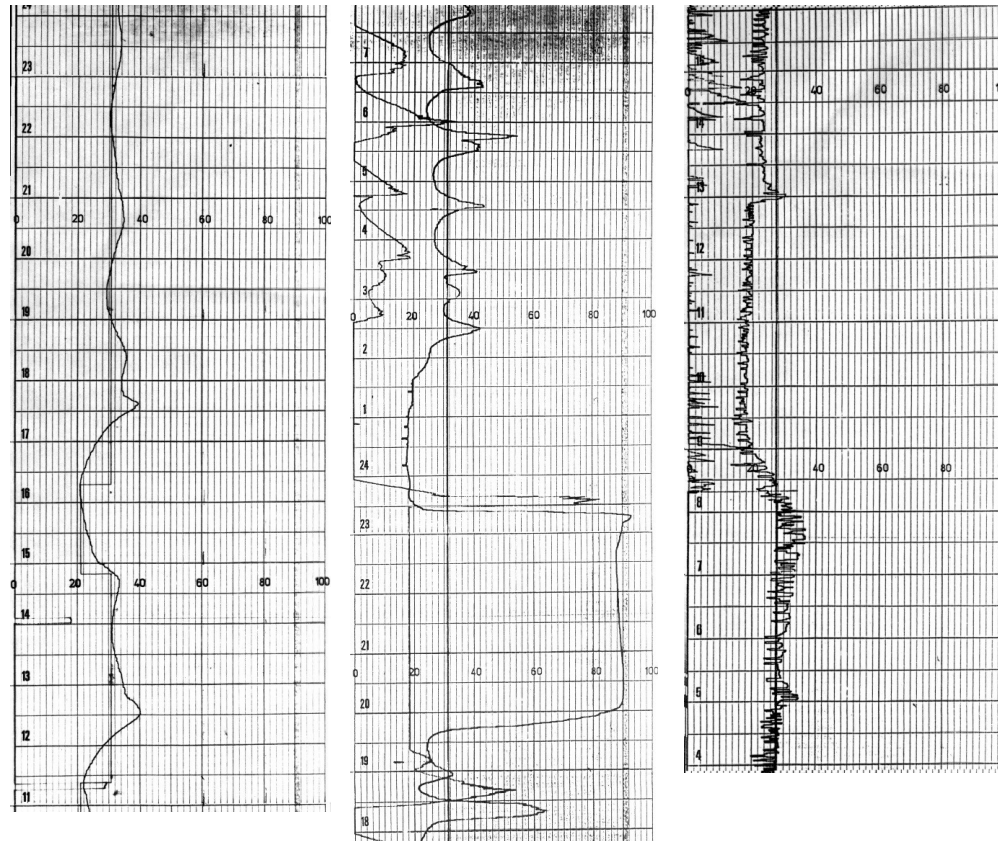
The process gas (green) contains ammonia, which is washed off with acidic washing liquid (blue). Various acids (red) are constantly added to the liquid to keep the pH of the scrubber sufficiently low.



Ammonia scrubber pH control

Data from the same pH process has been collected on different days (using conventional nonlinear PID-controller).

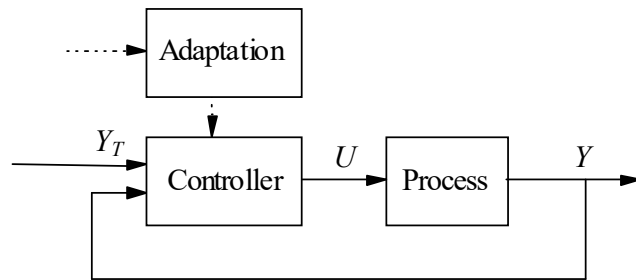
Behavior of controlled pH is completely different on consequent days



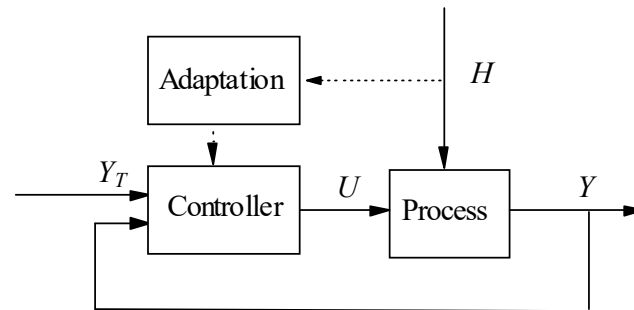
pH control

- Challenges with an ammonia scrubber:
 - The compositions of both the reagent gas to be washed and the acidic washing liquid change all the time: sometimes a drop of acid can push the pH-value over the scale for hours, and sometimes huge amounts of acid have practically no effect on pH at all.
 - If the pH is too low, even acid-resistant process equipment will corrode – and if the pH is too high, the ammonium will not be washed off and it will escape into nature.

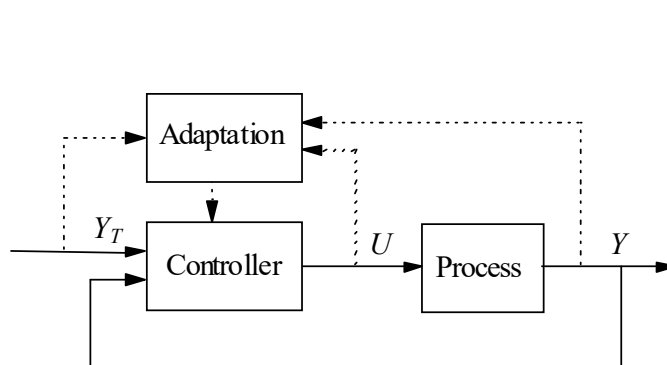
Adaptive Control Strategy



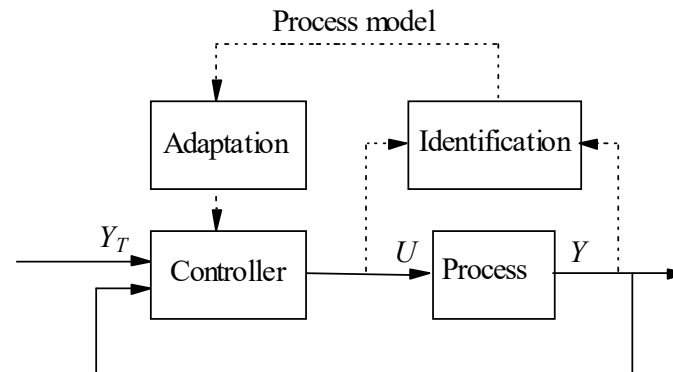
Open adaptive adjustment



Adaptive control with feedforward coupling



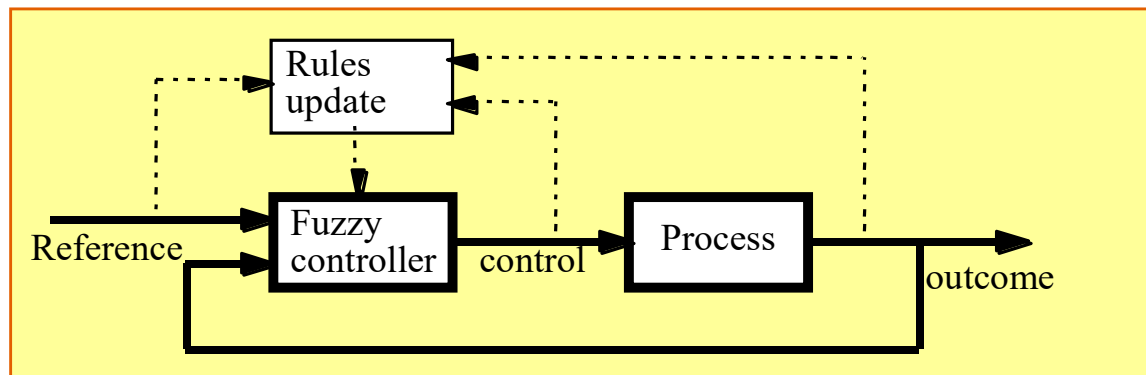
Feedback (direct) adaptive control



Feedback (indirect) adaptive control

Self-Organizing Fuzzy Controller (SOC)

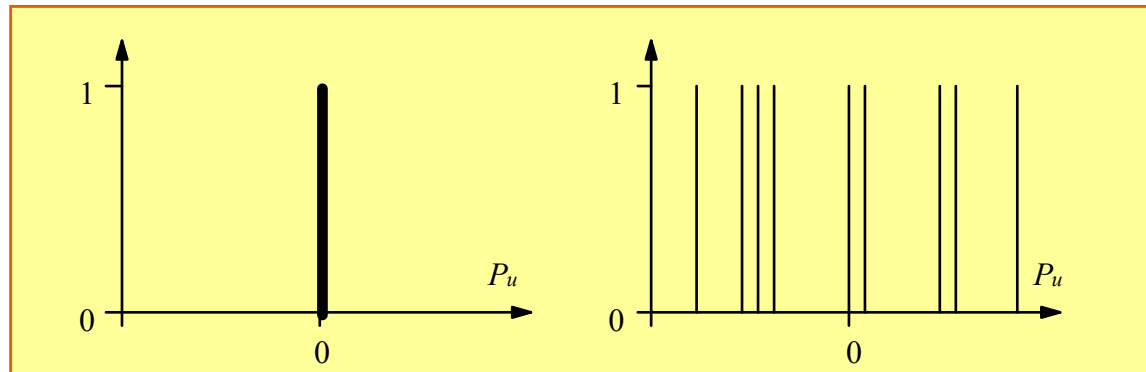
- The controller is a PD+I-type fuzzy controller, the positions of the control membership functions of which adapt on a case-by-case basis (learning controller).



Self-organization

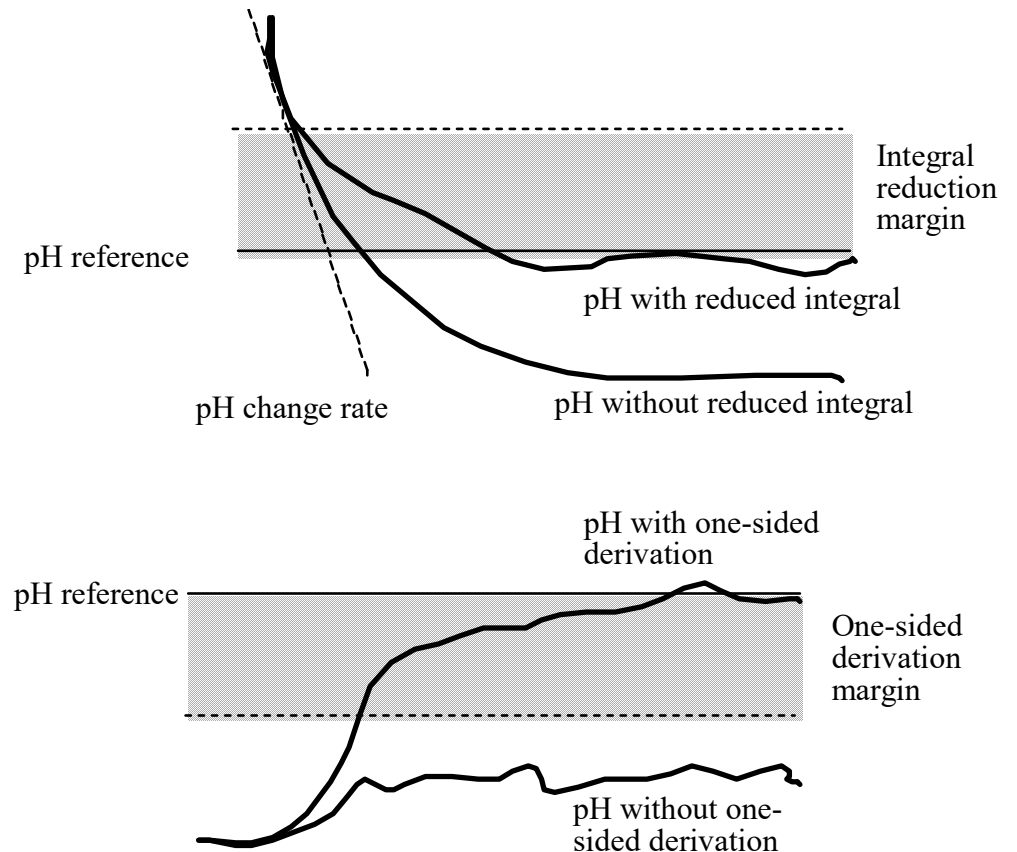
- Control (membership functions of the controller's output signal - the positions of the singletons are organized into new positions)

IF $e(k) = \mu_{e_i}$ AND $\Delta e(k) = \mu_{\Delta e_j}$ THEN $u(k) = \mu_{u_l}$



Ammonia scrubber pH adjustment

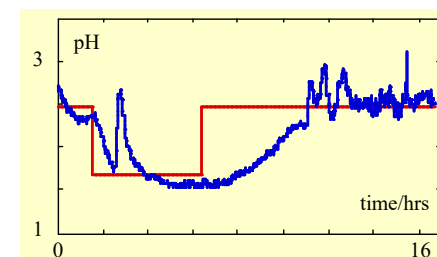
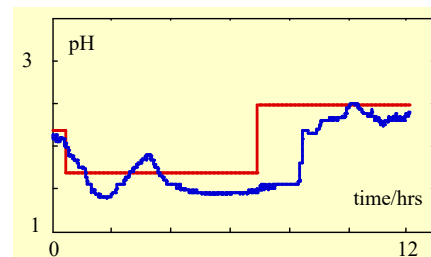
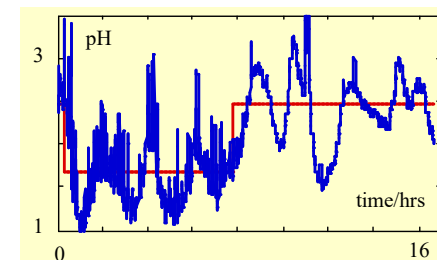
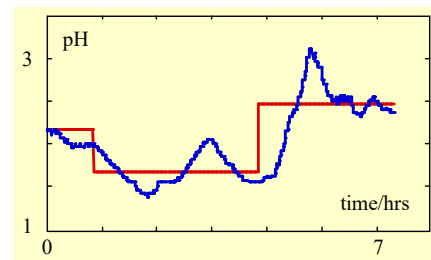
- To compensate the problems caused by one-sided steering, the derivative and integrative parts of the controller were made conditional
- When the response is going to the integral threshold area, the integrative action reduced (to prevent overshoot) and when the response is in the derivative threshold area, the derivative action decreases (to promote the push from risky region)



Controlling the time variant system with adaptive control

- pH was controlled with a fixed parameter PID (top row) and adaptive self-organising fuzzy PID (bottom row) on different days (different columns).

The adaptive controller adapts as the behavior of the process changes.



AI today

Case: Immigrant integration

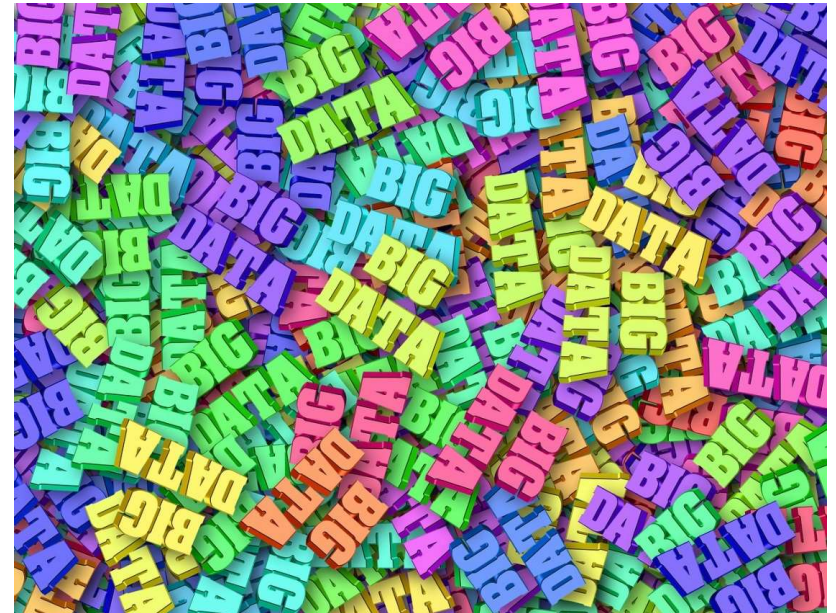
Integrating Immigrants to society and
work force

VTT

Big Data

Big data is a collection of data from traditional and digital sources in an ecosystem that represents a source for ongoing discovery and analysis.

- “volume” (the quantity of data),
- “velocity” (the speed of information generated and flowing)
- “variety” (the kind of data available)
- “variability” (the inconsistency of the data available)
- “veracity” (the quality of captured data)
- “value” ...



Wide Data

Wide data is combined from a large number of different sources and registers combined. Often there is less data when compared to big data (i.e., small and wide data)

- Gartner recently predicted that 70% of organisations by 2025 will shift their focus from big to small and wide data for more context for analytics and making AI less data hungry



Improving the employment of immigrants is essential for Espoo

- Since 2000, the share of residents with an immigrant background has risen from 4 % to 20 %
 - 22 % among the working age population
 - 27,5 % among the first grade pupils
- Unemployment rate among foreign nationals has remained on average 2,3 times higher than the general unemployment rate
- At the same time, more and more employers are suffering from the labor shortages
- The ongoing population change highlights the importance of finding solutions
 - In 2035 nearly 40 % of the under 45-year-old working population will have an immigrant background
- Employment of the parents has a significant impact into the social mobility and academic & career success of their children

Traditional sectoral data-analytics



Language tuition

Employment officials,
educational institutions

Vocational or professional training

Educational institutions

Support in social or health issues

Social and health
services

Help in job hunting

Employment officials, HR
companies

Student
registers

Student
registers

Registers of social
and health services

Customer registers of
employment services,
income transfer
registers

The idea of the holistic process of integrating
into the host-society is easily lost by producing
sectoral services and by staring at the sectoral
register data...

No matter which sector you're
concentrating on, the truth seems to be
elsewhere!



Multiple source data-analytics



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Student
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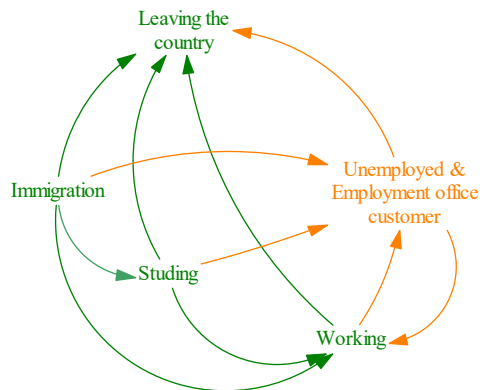
Registers of social
and health services

Customer registers of
employment services,
income transfer
registers

combining anonymized data from different sources in a secure way with the help of the social security number to analyze the effects of the skills centre services on public economy and labor-market status & well-being of the immigrants

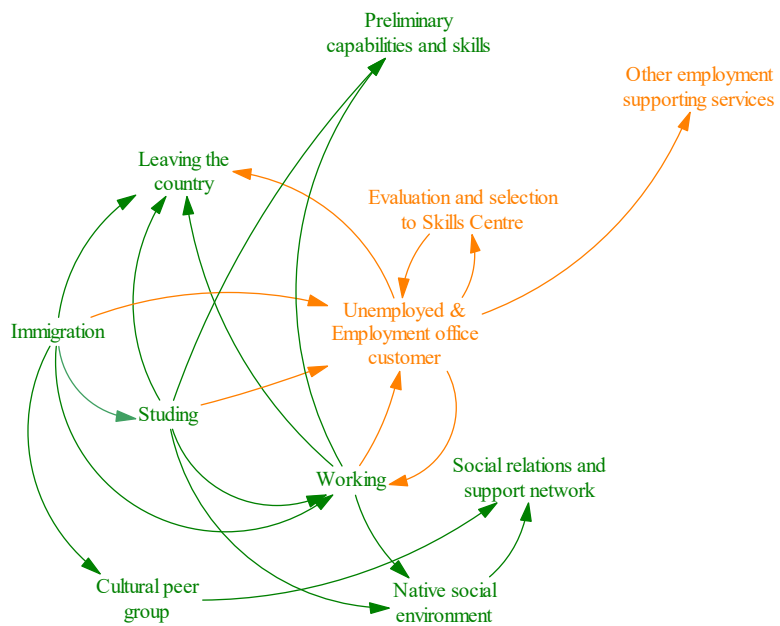


Complex causalities of immigration to multiple stakeholders

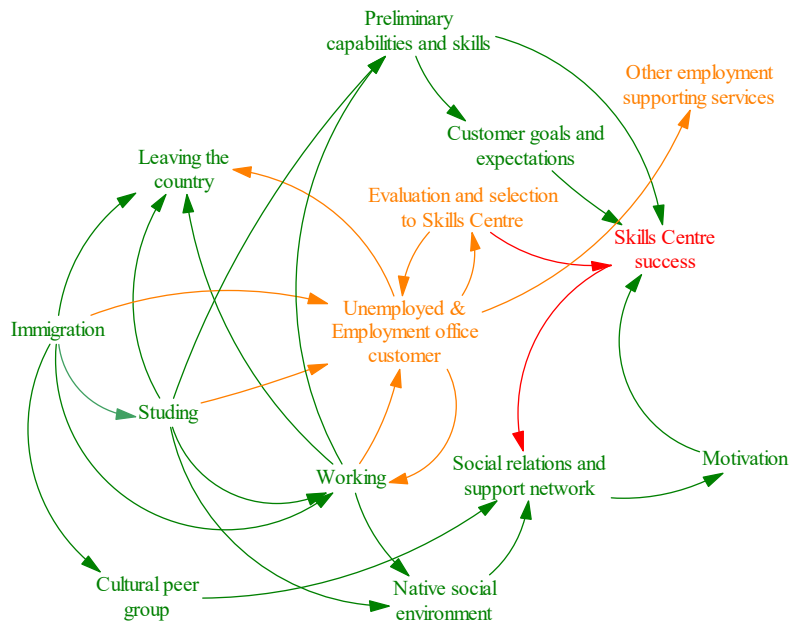


- No residence permit needed:
 - EU citizens
- Residence permit needed:
 - International protection (quota refugees, via asylum process)
 - For family reasons
 - Working
 - Studing

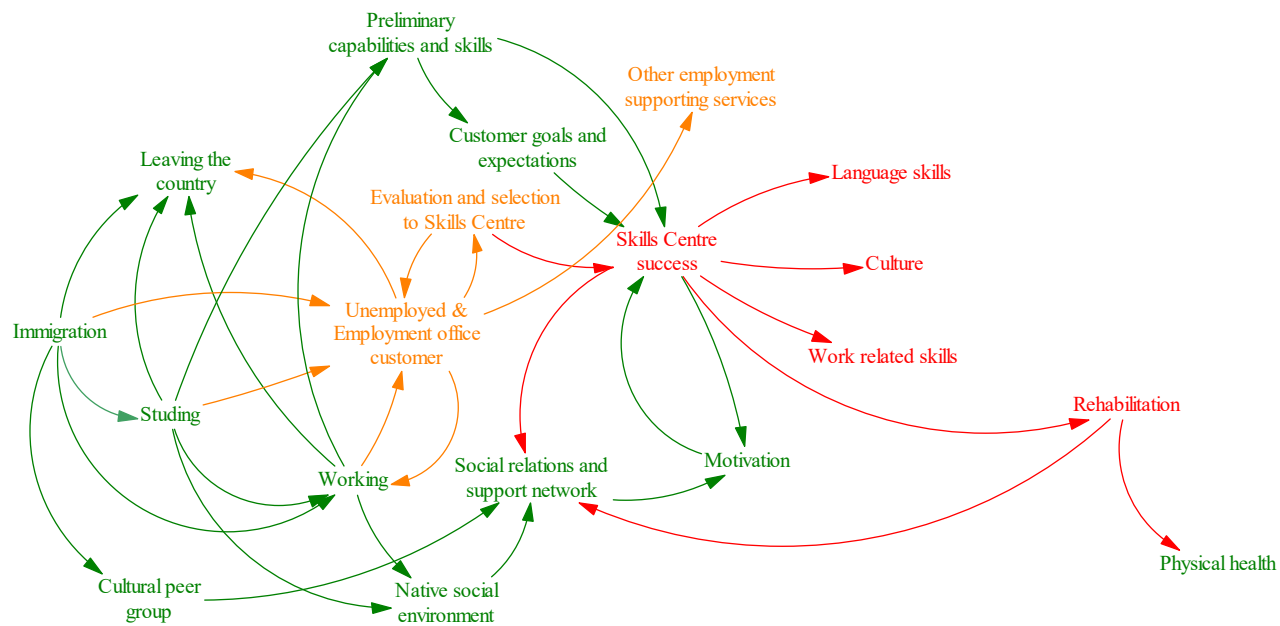
Employment office



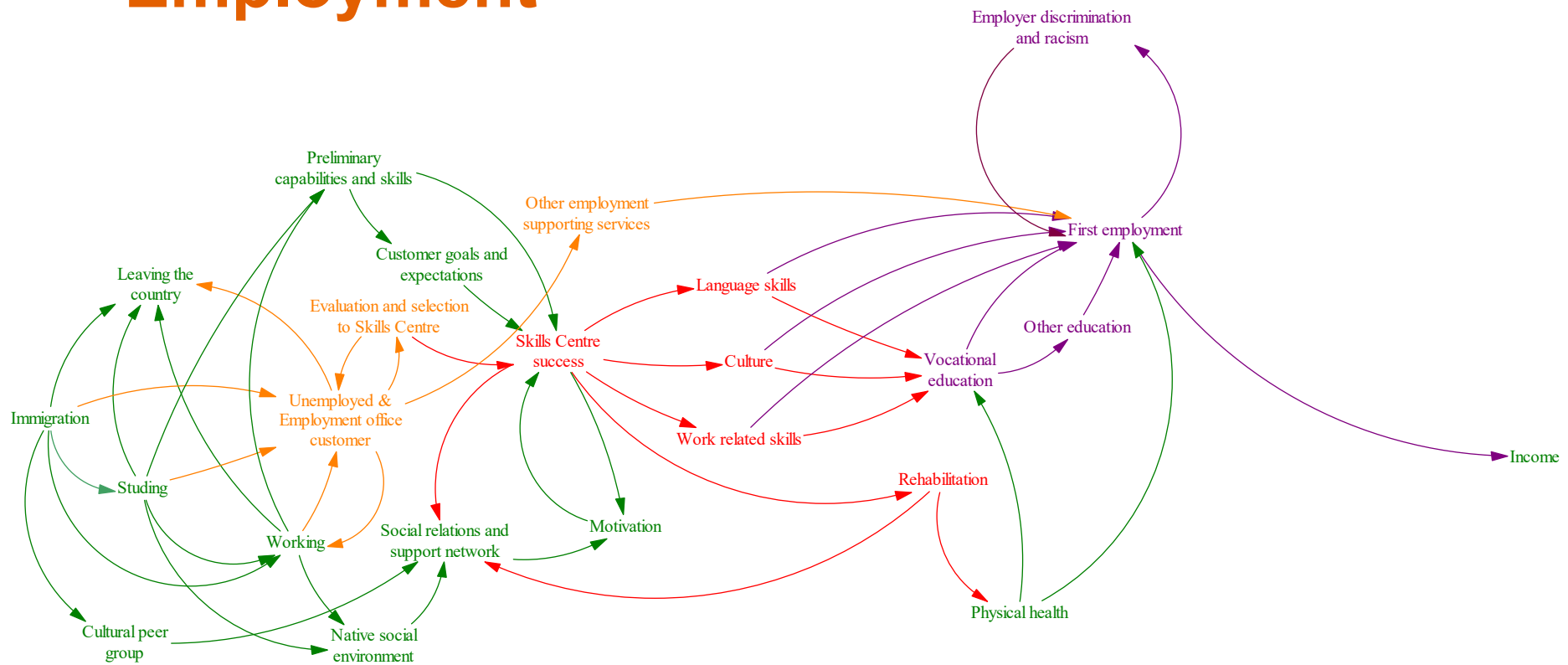
Selection to Skills Centre



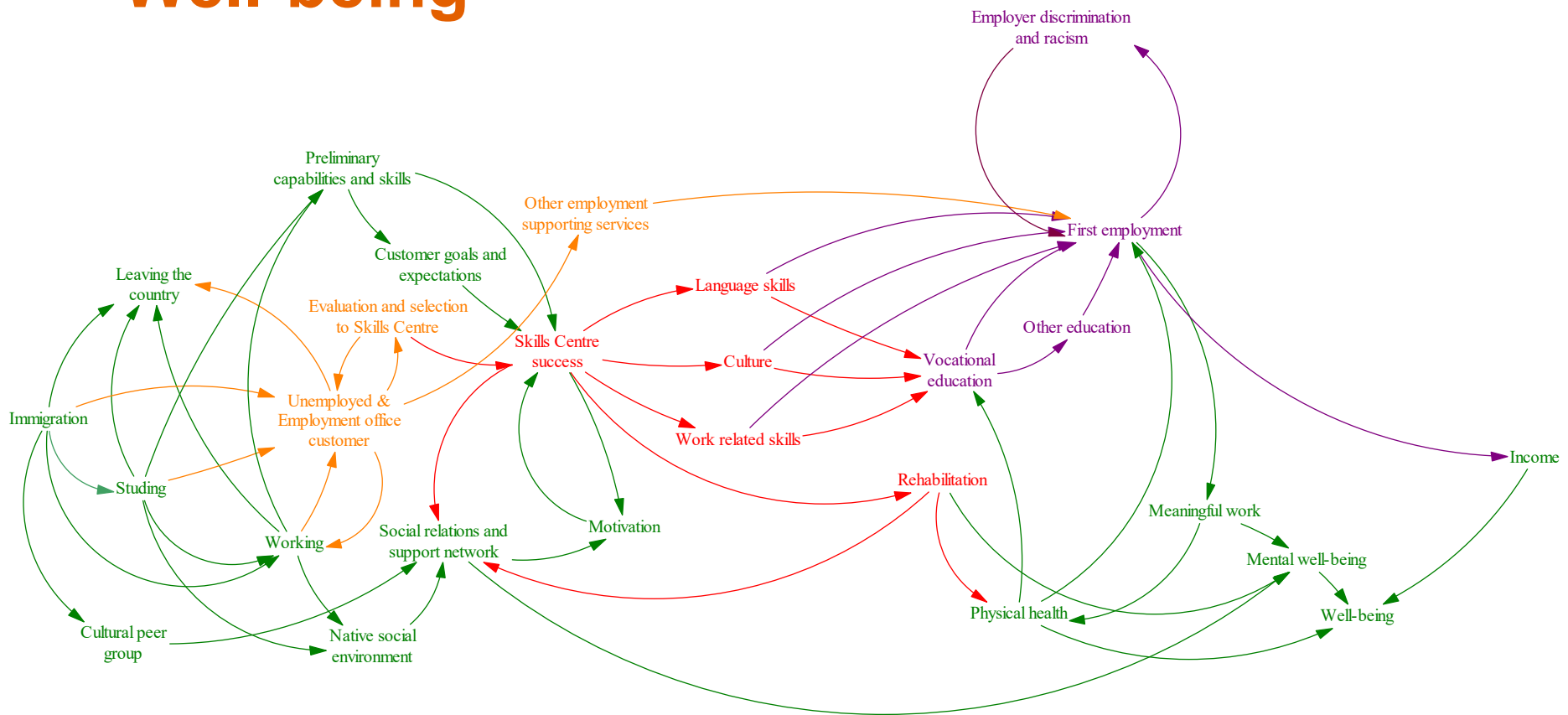
While in the Skills Centre



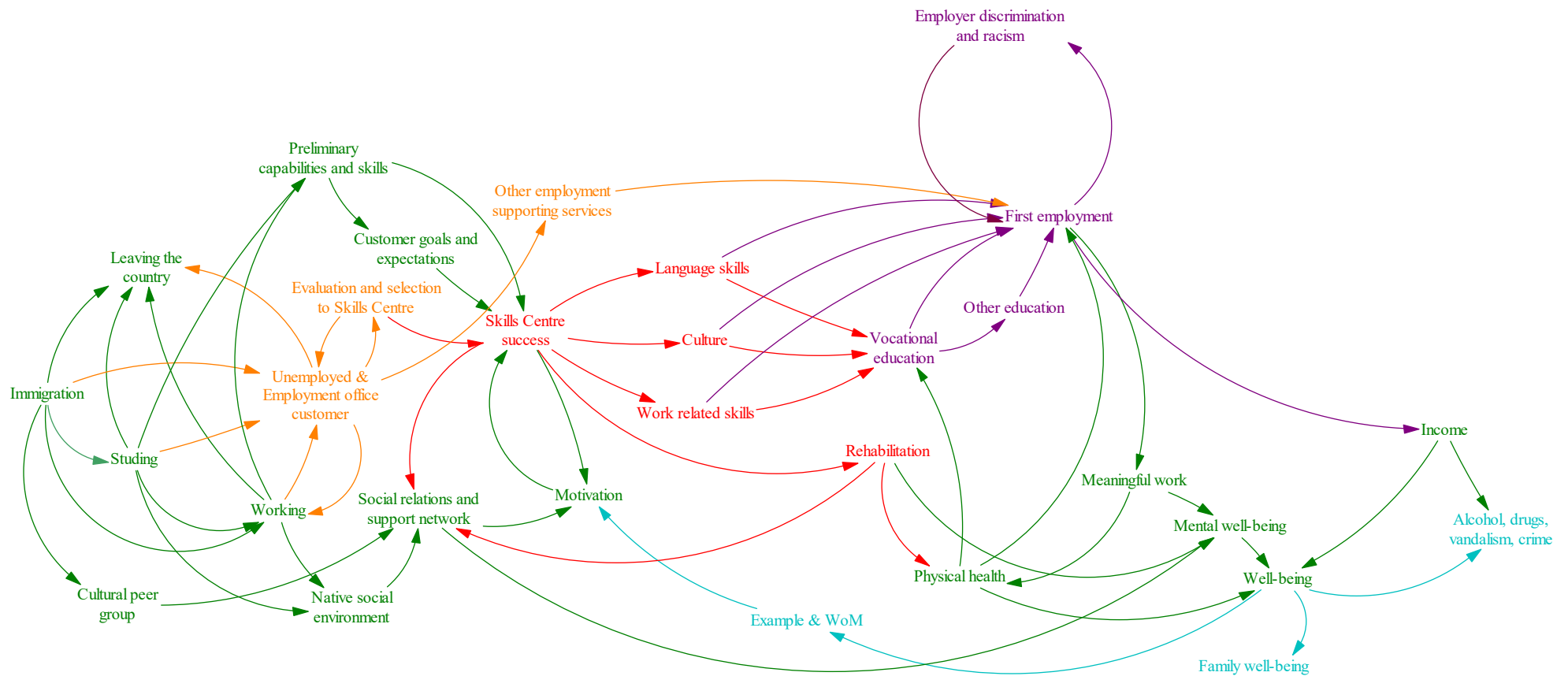
Employment



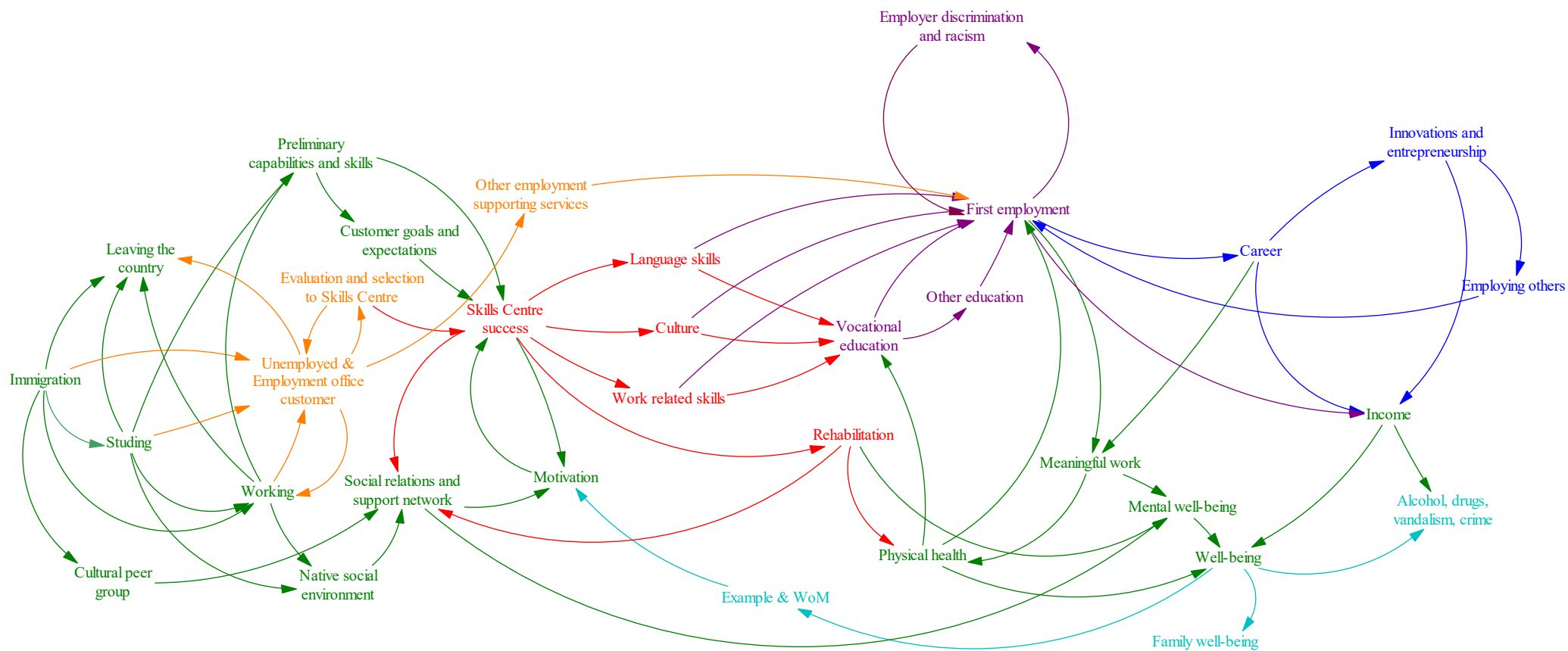
Well-being



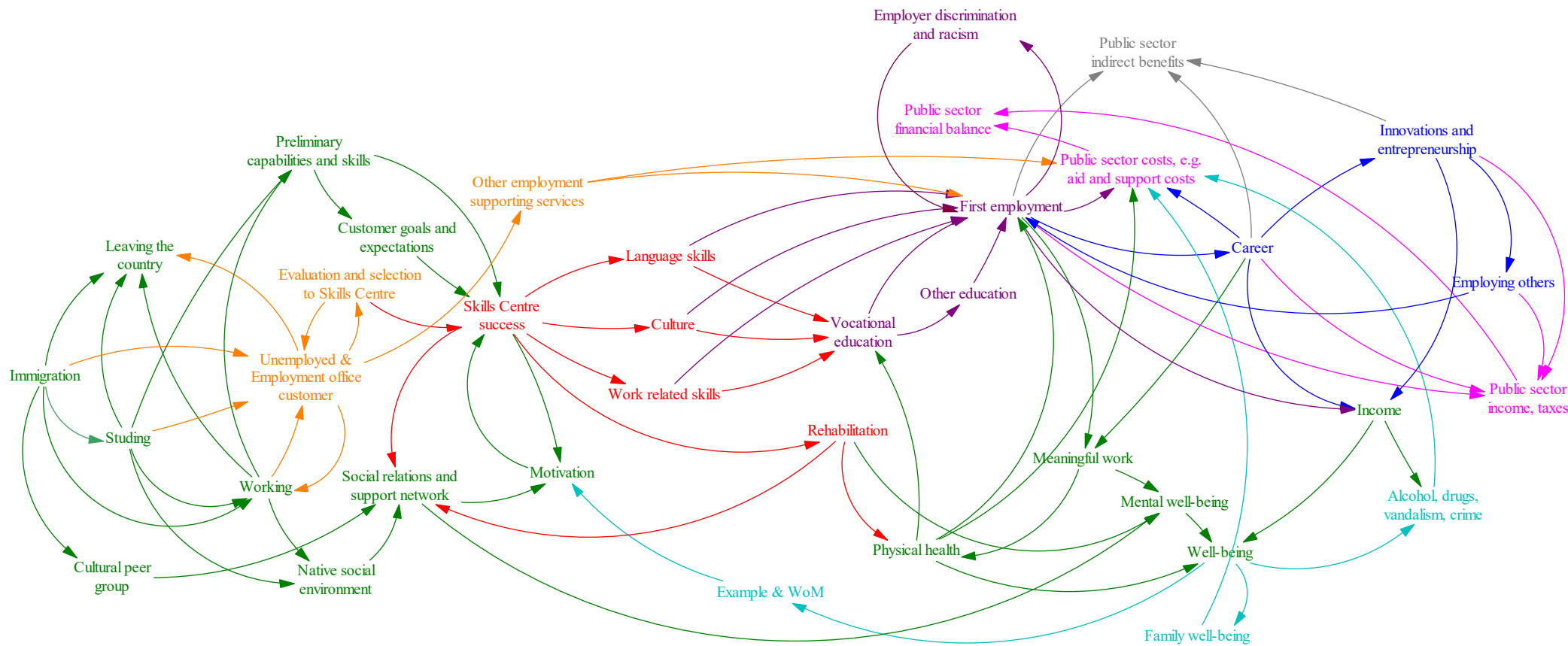
Indirect impact on near environment



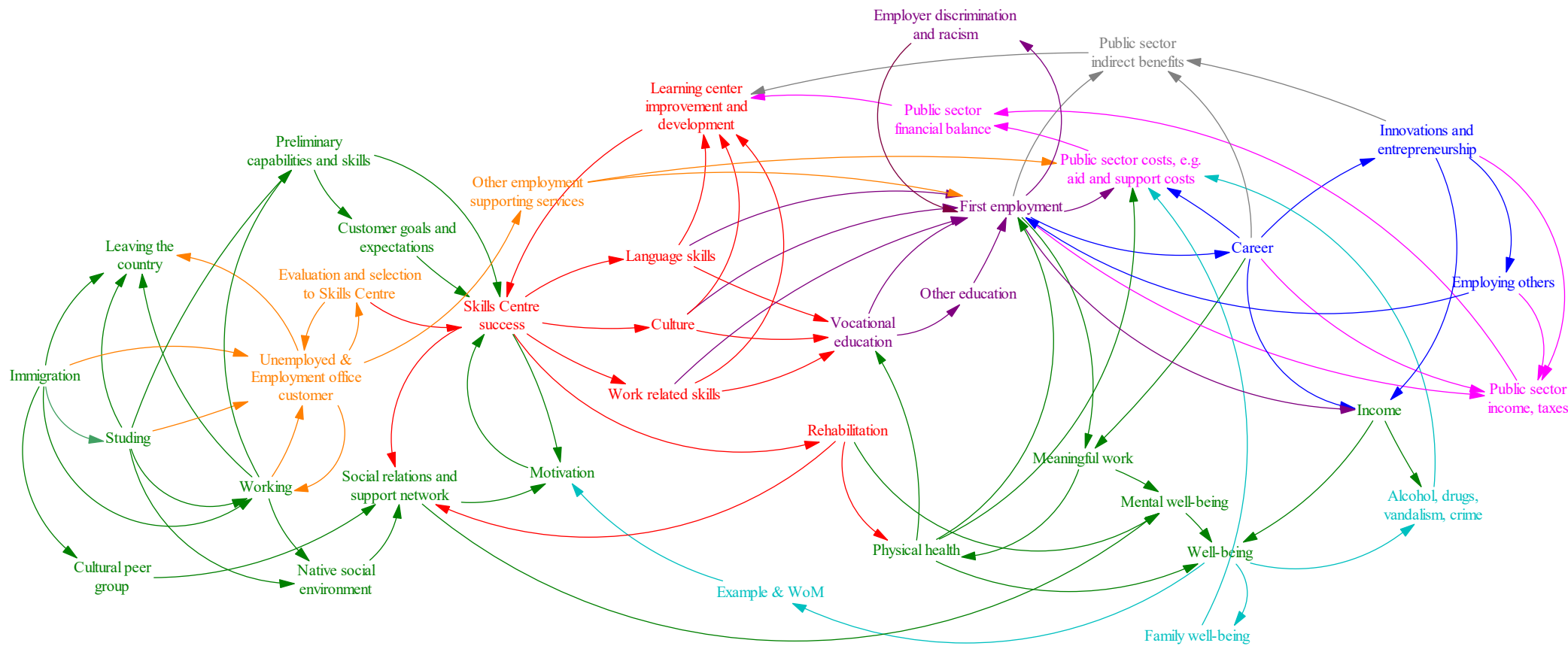
Career development, employing others



Impact on public sector

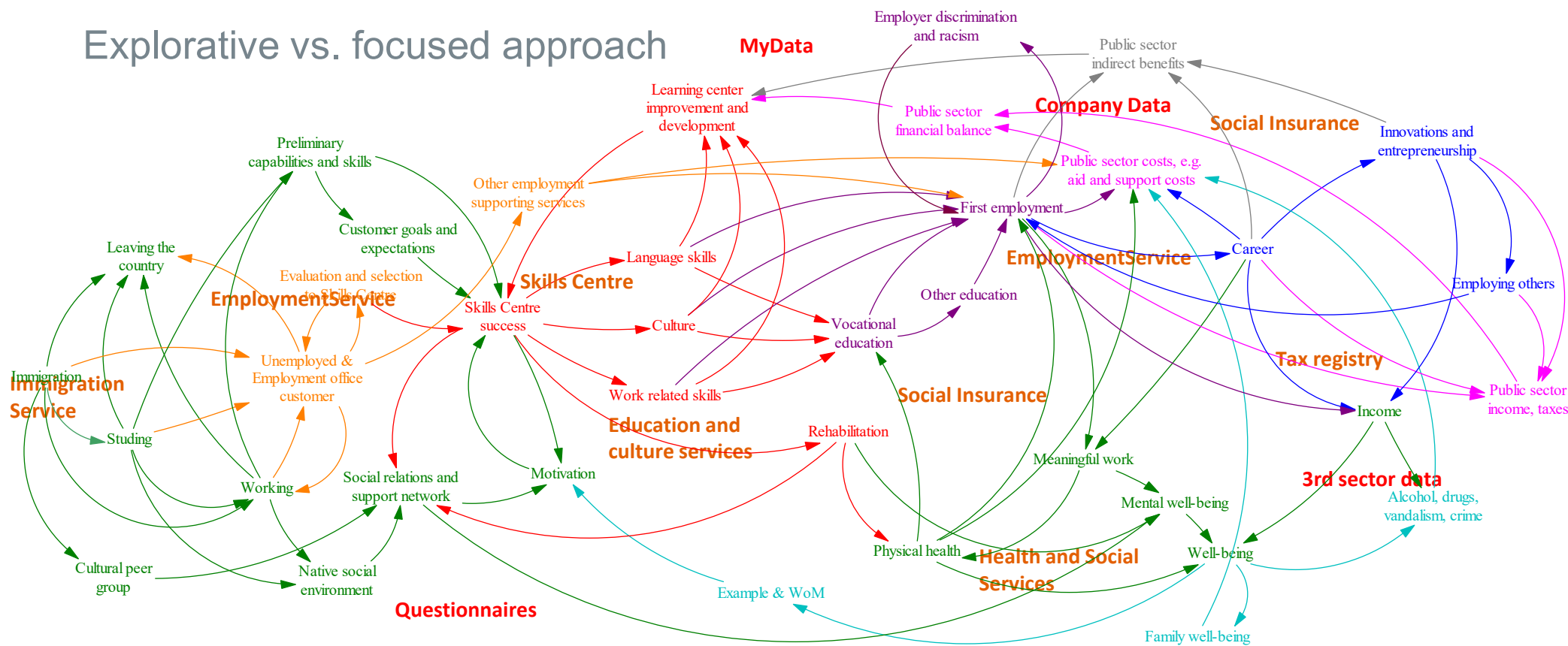


Skills Centre development



What kind of data can be used?

Explorative vs. focused approach

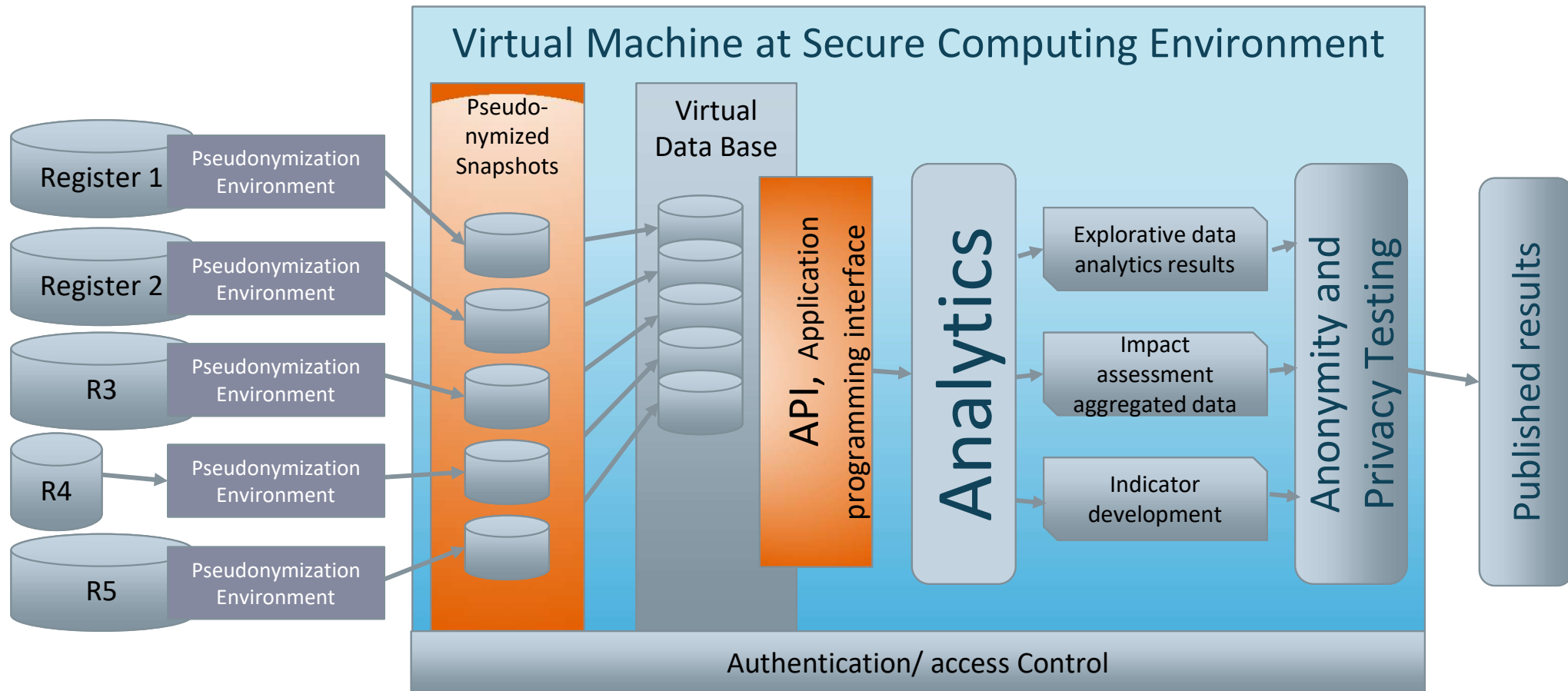


Integrating data from multiple sources

- Every resident in Finland has a unique social security number, that can be used for combining data
- Legislation (Act on Secondary Use of Health and Social Data) allows the integration of the data from multiple sources for research purposes without explicit consent
- EU legal framework General Data Protection Regulation (GDPR) sets guidelines for collection and processing of personal information
- Finnish Social and Health Data Permit Authority Findata promotes secondary use of Finnish social and health care data, facilitates data permit processing and improves data protection for individuals



Virtual data bases



Recent developments and options for Finland

Recent developments

- AI is essential for the competitiveness of the industry
- Generative AI made a significant breakthrough over two years ago with the release of ChatGPT. Companies are now experimenting with tools like Copilot in various tasks
- The focus has shifted from optimizing production processes to service business
- The key competitive factor is access to essential data and the ability to refine it into useful information
- AI projects require support from the company's board and top management
- It's important to start implementing AI from the business's own needs

Possibilities for Finland

- Finland has all the prerequisites to build AI into a new national success story, but it requires a break from the current trend of efficiency
- The AI factory built around CSC's LUMI supercomputer strengthens computational capacity
- Finnish AI research is high-quality, with strong technological expertise and a well-educated workforce
- Finnish industrial companies have moved from AI experiments to enhancing operations and developing service businesses
- Finnish companies have the opportunity to become AI pioneers, but it requires courage to innovate, scale, and invest
- We can still decide whether we will be among the winners or losers in the future of the AI era



Thank you for interest

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