Population projections for migration scenarios, human capital development, and sustainable integration

PI: Wolfgang Lutz (MigScene)

Executive summary

The most important economic asset of a population is its human capital: the skills, educational level, and wellbeing of citizens. Educational expansion and international immigration can increase human capital and mitigate the negative consequences of population ageing. Attracting skilled migrants is key for increasing productivity, and their integration in a way that promotes social cohesion involves new demands to the educational system, social services, and society at large. This challenge is shared by all high-income countries but is especially astute in Finland, with its stalling productivity and educational levels, ultra-low fertility, modest recent history of immigration, and stark concentration of immigrants to the capital region. At the same time, Finland remains a stable and democratic country with high population wellbeing and is increasingly attractive to international talent. Our globally pioneering role as the first wealthy welfare state with a highly aged population provides an opportunity to benchmark best practices in data-driven immigration and labour policies.

The proposed consortium responds to these challenges and opportunities by exploring how human capital and productivity may evolve in Finland under various educational, migration, and integration scenarios. We present a set of multidimensional population projections for Finland up to 2070, study integration processes and human capital prerequisites, employ methodological innovations, and enhance capacity to use projection tools in education, policy, and research. Specifically, we address the following questions: What are the likely future scenarios of human capital development in Finland, given different types of migration and educational policies, and how do they compare to other high-income countries? How do different scenarios, taking into account uncertainty as well as possible future migration 'shocks', affect labour force productivity, public expenditure, and especially the Finnish pension system? How can Finland compete internationally given the intensifying 'war for talent', and successfully integrate skilled immigrants and their descendants in different regions? How can services and education ensure all children and youth enter adulthood with optimal capabilities, the starting point for a productive and flourishing adult life and healthy ageing?

To answer these questions, MigScene brings together an internationally renowned PI with leading Finnish expertise in data science, economics, demography, and the social sciences, and an international network of population projection centres and experts. The project feeds on constant and systematic interaction with key ministry and policy stakeholders and the major cities in Finland and promotes coordinated and skilled use of population policies and projections. Scientific breakthroughs are sought regarding the scope and indicators of human capital. AI is deployed to enhance the development and use of human capital indicators and adoption of projection tools.

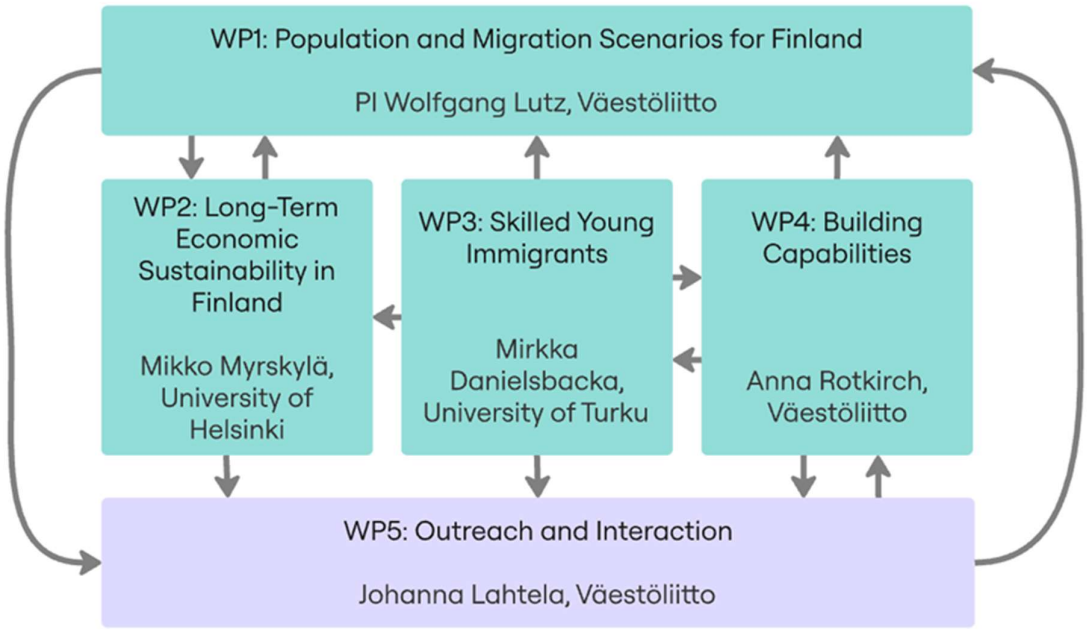
State-of-the-art population projections are key for policy, planning and evaluation and encompass the educational, labour force and migration policies. However, current
national and regional population projections are unevenly utilised and do not take into account the dynamic and changing nature of migration trends or human capital developments. The existing Finnish microsimulation databases (ELSI, SISU, Kela) are useful for population projections, but are limited by scant data on immigration backgrounds, integration, and wellbeing. They also have restricted access and are difficult to use.

MigScene will present population scenarios and policy recommendations on national and regional levels, and for immigrants' skill development and sustainable integration in different regions of Finland, with a focus on younger generations. We create a new Finnish microsimulation system aimed for general use, employ other national and international microsimulation databases, and develop macro-level projections using a rich array of high-quality survey and register data. Many scenarios of future productivity assume improved capabilities and higher human capital in the future, yet such optimism no longer seems self-evident, and we also explore less optimistic scenarios. In cooperation with Statistics Finland and relevant stakeholders, we aim to synergise the current disparate, uneven and overlapping use of population scenarios in ministries and municipalities and strengthen the use and easy adaptation of this key policy tool.

Research implementation

The four core research questions are tackled by four Work Packages (WP), with interaction as the fifth WP. The work packages are interlinked and feed key outputs to each other (Figure 2).

Figure 2. *Work package output flowchart.*



WP1: Population and Migration Scenarios for Finland, led by Wolfgang Lutz (Population Research Institute, Väestöliitto). WP1 deploys a Finnish and an international microsimulation model to achieve four core aims.

1.1. We develop *a multidimensional population projection model for Finland* using microsimulation. The model will be based on the internationally recognized approach developed by Marois and KC (2021) and Bélanger and (2017), which has been applied in several demographic and policy contexts (van Hook et al. 2020; Marois, Bélanger & Lutz 2020; Gietel-Basten et al. 2024; Marois, Gietel-Basten, & Lutz 2021; Marois, Potancokova, & Gonzalez 2023). It will be *dynamic* and *time-based*—simulating year-by-year transitions in individual life trajectories. Starting from a detailed base population, the model will simulate life events such as mortality, fertility, migration,

educational transitions, and labour force participation, using transition probabilities that vary with individual characteristics. Unlike most existing models that rely on public dataset from surveys or census data—often limited in sample size or scope—our model will use the rich Finnish civil registry, which allows the inclusion of many dimensions and their interactions. This enables modelling of immigrant integration processes, such as employment trajectories, geographic settlement, mobility, fertility patterns, and the educational attainment of their children.

WP2: Long-Term Economic Sustainability under Uncertain Population Dynamics is led by Mikko Myrskylä (University of Helsinki) and consists of two interrelated modules, 1) Long-term economic sustainability and 2) Probabilistic population forecasting.

WP2 package puts forward probabilistic projections for public expenditure scenarios and demographic trends in Finland under alternative migration and human capital scenarios. Using ELSI, the computational microsimulation model developed by the Finnish Centre for Pensions (ETK) that includes a detailed implementation of the Finnish social security, pension, and labour market system (Tikanmäki & Lappo 2020), we analyse how migration-related scenarios affect long-term sustainability. The work with experts from Finnish Center for Pensions and their ELSI model builds on past successful collaborations that analyzed to what extent investments in human capital can compensate for the long-run negative economic impact of low fertility (Myrskylä et al. 2025). However, this past work ignored the migration and uncertainty in population dynamics, a key focus of WP2.

To state the risk of scenarios occurring we *integrate probabilistic models of future population composition and migration flows with ELSI*. The construction of *probabilistic scenarios* is a key innovation. It allows us to not only test the robustness of Finland's economy under some fixed conditions, but to also state the likelihood of each scenario (Rafael & Selin 2014). The research team has extensive expertise on developing probabilistic forecasting models (Bohk-Ewald, Li, Myrskylä 2018; Hellstrand et al. 2021), and are already working together with Statistics Finland to implement these into official statistics production.

> **Module 1 "Long-term economic sustainability",** led by Dr. **Sanna Kailaheimo-Lönnqvist**, assesses the development of economic sustainability and public expenditures under various migration and human capital scenarios in Finland.
>
> **Module 2 "Probabilistic population forecasting"**, led by Dr. **Julia Hellstrand**, focuses on methodological improvements in population forecasting in Finland.

WP3: Skilled Young Immigrants, led by Mirkka Danielsbacka (University of Turku).

One of the most effective ways of integration is to strengthen immigrant ties to the host country through family connections. WP3 studies *ways to attract and retain skilled immigrants* and their children, and the likely trajectories of employment, productivity and family formation of different immigrant groups and generations. WP3 will study all immigration groups (all ethnicities and educational groups) in the population, with a focus on highly skilled immigrants, and in particular those who have come to Finland to study for an academic degree (Mathies & Karhunen, 2021; Mosneaga & Winther, 2013). In 2023, over 30 000 international full degree students were enrolled in universities and universities of applied sciences, which is around 9% of all students.

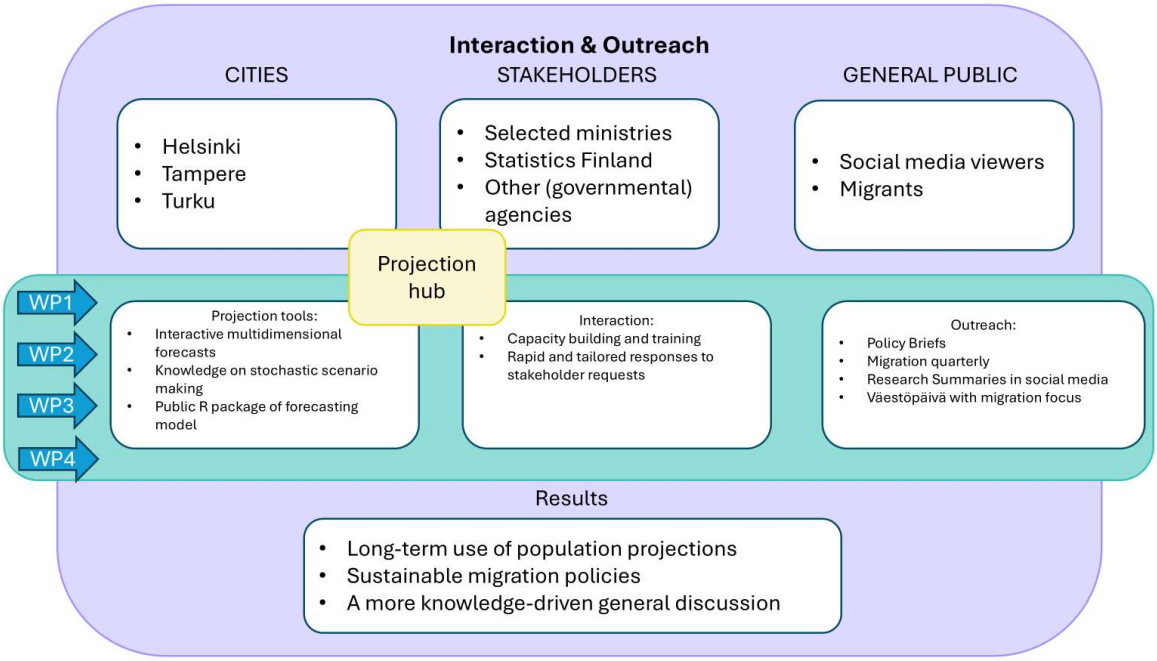
WP4: Building Youth Capabilities, led by Anna Rotkirch (Population Research Institute, Väestöliitto).

WP4 adopts a *child-centred perspective* on cognitive and wellbeing outcomes. Different age cohorts and generations have different economic and family realities (*pace* Kalmijn & Leopold, 2021), which often get lost when statistics represent the current labour force. Many scenarios of future productivity in Europe assume stable or improved skills of younger generations. However, educational levels have stalled in Finland and are now below the OECD average (33% for men and 46 % of 25–34-year-old women in Finland hold a tertiary education, compared to 41% and 54% in the OECD. Also, mental health and youth deaths have deteriorated during the last decade. Finland also has comparatively high levels of societal exclusion of young men, especially men with a migrant background, as the first larger cohorts of second-generation immigrants reach adulthood (OECD, 2024; Estévez & Rotkirch, 2024). Another starting point is that better use of the vast and existing knowledge base of families, children and youth is needed for cost-effective and timely policy decisions. We and assess *the wellbeing of children and youth among those with both native and migrant backgrounds*. The key focus of the WP is what indicators best capture the *capabilities among young adults*, the future adult generations. The concept of capabilities has received many different and varying applications. Here, we approach it as the potential for the development of manifest human capital in adulthood, and a new human capital indicator in projections. In other words, capabilities denote the social, cognitive and developmental prerequisites for the "freedom to lead different types of life" (Sen, 1993) at the threshold of adulthood.

Implementation of interaction

The endpoint of each MigScene research step is the long-term use of population projections and sustainable migration policies. We aim for national capacity and infrastructure that persists after the project. This part of the interaction work package is called the **Projection Hub**. Other ways of interaction, popularisation, media contacts and outreach are here summarised under **Outreach** (Figure 3).

Figure 3. Interaction and Outreach flowchart.



Key consortium interaction bodies

Steering group. The national Steering Group includes 7–9 key stakeholders and leading economists. The SG meets live for half a day once per year to discuss project progress, results, and eventual concerns. Extra meetings may be held if major geopolitical events occur and create new demands for scenarios. Members can ask for consultation and information continuously.

Scientific Advisory Board meets yearly**.**

Projection Hub. Our single main output is to improve migration and population **policy tools and statistical infrastructures** in Finland through the Projection Hub, which will benefit collaboration partners, policy makers, and scholars. The Projection Hub aims to

(i) provide *multidimensional population forecasts* and the capacity to use them

- spread knowledge of Finnish *microsimulation models* developed and used in the project*,* and knowledge of how to use them
- spread *knowledge of stochastic scenario* making
- provide the forecasting models in a documented and *public R package* that allows easy use of the forecasting approach within the scientific community and beyond.
- develop a *user-friendly chatbot*, using a conversational approach empowers users and helps them to better understand the assumptions, uncertainties and scenarios plausible via different policy pathways.

(iv) coordinate and provide *capacity building and training:* teaching students at MA, PhD and post doc levels through courses and summer schools at the University of Turku and its INVEST flagship, and the University of Helsinki, and through international exchange of visiting scholars to IIASA and Max Planck Institute

(v) create a *Population Quarterly newsletter*, which follows Statistic Finland releases on migration (March), births (June), ageing (September) and marriages (December). The Quarterly comments on the newest statistics, adds our own variables (e.g., migration retention rates, tempo-adjusted fertility rates, years of Good Life in ageing, and the gap between wishing for a partner and having one, as well as wishing to be a parent and actual fertility, in different population groups), and provides EU / OECD / global context to it.

(v) facilitate constant, *rapid and tailored responses to collaborator and stakeholder requests*. Experience shows that needs may arise in relation to a ministry report, a new initiative, or an unexpected event.

International Scientific Advisory Board:

- **Anne Goujon**, Programme Director, Population and Just Societies, International Institute for Applied Systems Analysis (IIASA)
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