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PRACTICAL MODELS FOR IMPLEMENTING AI AND LANGUAGE TECHNOLOGIES (EXPERIENCE OF ICELAND AND BELGIUM)

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A working group held meetings with representatives of the Alexandra Institute (a Danish private non-profit organisation specialising in research and practical solutions in the field of language technologies and AI), AI Sweden (which performs a similar role in Sweden), and the Norwegian organisation NorwAI. A similar structure operates in Finland.

The Alexandra Institute is one of seven institutions in Denmark recognised as Research and Technology Organisations (RTOs) according to the definition of the Danish Ministry of Education and Science. All are private non-profit institutions whose mission is to conduct research into cutting-edge technologies and develop technological solutions for the benefit of Danish industry. The Institute's primary task is to ensure the application of language technology and AI solutions for the public and industry – a challenge that is currently most acute for Iceland.

AI Sweden is a research-oriented institution with a different approach to implementation than the Alexandra Institute. Although it is also a private non-profit organisation, its regulatory environment is not comparable to that of Danish RTOs.

Both institutions bring together researchers and end-users of the solutions for which the research is intended. They bridge the gap between infrastructure and end-users, and between scientists and the economy. Everything takes place “under one roof”: the institutions employ scientists and researchers to carry out applied research and technological development, provide solutions to end-users, and maintain close cooperation with other researchers, particularly from universities and industry. Moreover, all solutions developed under this model are released as open-source software and can therefore be used more widely across society. These institutions integrate research and development in language technologies on the one hand and artificial intelligence on the other – an approach considered optimal for the future, given the increasingly close interconnection between AI and language technologies.

This model differs from the one previously implemented in Iceland under the earlier Language Technology Programme, where the government defined

tasks to be carried out by the language technology community over a four-year period and then entrusted a private non-profit organisation, Almennarómur, with acting as an intermediary in these projects and monitoring their implementation. The technical development of the projects was carried out outside Almennarómur – either in universities or in language technology companies. This meant that the knowledge gained during development, as well as the solutions themselves, remained with those universities and companies, even though the solutions were published under open-source licences. In addition, Almennarómur had no clearly defined role in engaging industry in the projects or ensuring the development of solutions suitable for relevant sectors in close consultation with them.

Although this arrangement proved successful, the steering group believes that the objectives of the next programme will be better achieved by other means. In the group's view, the government should aim to establish an AI and language technology institution in Iceland comparable to those existing in the Nordic countries and across Europe. The main advantages would include:

- the creation of a permanent hub for AI and language technologies in Iceland, ensuring accountability, continuity, and stability in both fields;
- funding mechanisms in which resources are pooled from government, private companies, and international grants, creating a strong incentive for technology adoption;
- shared use of critical resources such as computing power;
- continuous development of knowledge in AI and language technologies and its dissemination within the institution.

Many factors require further study with regard to Iceland: whether the government should participate directly in such an institution or support a private non-profit organisation following the Danish model; whether private companies are interested in co-financing it; and a thorough analysis of the legal environment in Iceland for such institutions compared with the situation in the Nordic countries. Establishing such an institution will be a complex and time-consuming task.

The steering group recommends that the Ministry of Culture and Business immediately begin cooperation with the Ministry of Higher Education, Science and Innovation (responsible for artificial intelligence issues) to conduct a feasibility study on the creation of a language technology and AI institution in Iceland, modelled on Nordic examples. The ministries will then decide on the advisability of establishing such an institution and on integrating these efforts with preparations for the next language technology programme.

Funding for the previous Language Technology Programme was provided mainly through two channels: direct contributions from the Ministry of Culture and Business or through competitive funds. The Strategic Programme for Research and Development in Language Technologies is an open competitive research fund operating under the Act on Public Support for Scientific Research. Funding is allocated according to objectives set by the fund's council, based on

expert evaluation of project quality, scope, need for results, the competence of the researchers, and their ability to devote the necessary time and effort to the project.

A major challenge for Icelandic language technologies is the effective delivery of language technology products to users. The current project funding model does not fully address the challenges facing Icelandic language technologies. It is important to review the funding mechanism to give the government a better overview of ongoing projects.

Centralised funding was provided for implementation projects. It was therefore proposed to leave the Strategic Programme for Research and Development in Language Technologies unchanged until 2026. Special grants for the implementation of Icelandic language technologies were established, covering both grants for final solution projects using language technology infrastructure and support for the general implementation of these infrastructures in existing systems.

Under these grants, Icelandic companies can apply for funding to implement language technology solutions in their services or to use the language technology infrastructure for further development of practical end-user solutions. Such grants were previously almost entirely absent from Iceland's grant environment, and companies in language technologies, educational technologies, and other stakeholders complained about the impossibility of obtaining necessary funding. The Ministry of Culture and Business annually allocated 60 million Icelandic krona for implementation projects. Almennarómur manages the funding, accepts applications, and distributes the grants. A grants allocation committee, consisting of the head of the Language Technology Programme, a representative of Almennarómur, and a representative appointed by the Minister of Culture and Business, evaluates applications and projects.

At the initial stage, particular attention is proposed for supporting solutions for healthcare and education systems. The potential of language technologies in these sectors is clear. Efforts will also focus on strengthening solutions for learning Icelandic as a second language, both in the school system and in the labour market.

There was a lack of centralised consultancy for companies interested in developing end-user solutions. It was proposed that Almennarómur take on this role, providing advice to companies and assisting with solution implementation. Almennarómur will also promote Icelandic language technologies among the public, organise conferences, and update its website to better present available solutions.

Efforts by Almennarómur, the government, and companies to integrate the Icelandic language into the solutions of global technology giants have already yielded results. Most companies are open to cooperation if it does not require excessive effort or costs.

The cooperation between the company Miðeind and OpenAI is an indicator of the quality of Icelandic language technology infrastructure. In May 2022, OpenAI selected Icelandic as the first language after English for which the GPT-4 model was specifically trained.

In spring 2022, Microsoft released the speech synthesis voices “Guðrún” and “Gunnar”, available in operating systems and cloud services. Microsoft also released the first Icelandic speech recogniser, developed using data from the open-source “Language Technology for Icelandic 2018–2022” project.

Google has released Icelandic speech synthesisers three times, largely due to pressure from the University of Reykjavík and the Icelandic Association of the Visually Impaired. In 2015, the voice “Anna” was released, based on recordings made by the university in cooperation with Google.

Under the next Language Technology Programme, infrastructure will continue to be released under open licences, and responsibility for cooperation with foreign technology giants (Microsoft, Google, Meta, OpenAI, and others) will be assigned to a single organisation that will initiate the integration of Icelandic into their products.

Language resources are the data on which language technology tools are built. Diverse and extensive data are required for developing and adapting tools to the Icelandic language. These data are used both for training tools and for testing and evaluating their quality and accuracy.

Key components include expansion of the Icelandic Gigaword Corpus, corpora for sentiment analysis, information extraction, summarisation, question answering, word sense disambiguation, text complexity analysis and simplification, multimodal corpora for sign language, personal conversations (video recordings), image-text pairs, and test data for evaluating large language models’ language understanding.

Text analysis components include coreference and anaphora resolution, automatic term extraction, automatic dictionary creation, text complexity and simplification.

Speech recognition development focuses on expanding coverage to as many social groups as possible (children, non-native speakers, elderly people), different software and hardware environments, code-switching detection, speaker recognition, and acoustic modelling.

Speech synthesis development aims at improving accessibility, business applications, audiobook production, synthesis of children’s voices, mixed-language texts, specialised terminology, prosody control, and integration into assistive technologies.

Machine translation is crucial for making Icelandic texts accessible to non-speakers and enabling Icelandic speakers to understand foreign texts. Priorities include high linguistic quality, handling of bias and hate speech, long-context translation, real-time speech translation, offline models, and integration with translation memories and specialised dictionaries.

Spelling and grammar checking tools must serve diverse user groups (non-native speakers, people with dyslexia, children) and be integrated into common text editors and smart devices.

Large language models adapted for Icelandic are being developed for question answering, text annotation, simplification, sentiment analysis, chatbots, contact centres, and dialogue systems. The goal is to ensure that future devices and software can understand, process, and convey information in Icelandic, thereby protecting the position of the Icelandic language in the fourth industrial revolution.

Since 2024, training vouchers have given employees and self-employed persons in Wallonia access to an increasing number of AI training opportunities. A training voucher worth €30 entitles the holder to one hour of training, with the cost shared equally between the employer and the region. In 2024, the regional budget for the scheme was €7,657,000, benefiting 9,539 companies and providing 496,063 hours of training to 27,860 workers. The number of AI training courses approved for vouchers increased by 85% compared to 2023. The online catalogue offered around 20 AI modules covering business productivity, management, legal aspects, marketing, finance, IT, and HR optimisation.

Effective implementation of artificial intelligence and language technologies has shifted from pure science to practical integration. The experience of the Nordic countries and Belgium demonstrates that success depends on three key factors:

1. Creation of Research and Technology Organisations (RTOs) where developers work directly on solutions for industry, medicine, and education.
2. Prioritising rapid implementation grants rather than long-term plans (e.g., integration of Icelandic into GPT-4 or Microsoft products).
3. Use of mechanisms such as training vouchers for large-scale workforce upskilling (marketers, financiers, HR specialists), enabling businesses to adapt to the AI revolution in real time.

Keywords: AI, language technologies, Iceland, Nordic countries, Research and Technology Organisations (RTOs), digital skills development, workforce training.

References

- Ministry of Culture and Business Affairs. (2024). *Language technology programme for Icelandic 2024–2026*. The Government Offices of Iceland.
- ReferNet Belgium, & Cedefop. (2025, June 4). Belgium: Wallonia trains its workforce in AI. *National news on VET*.