Trond Henning Olesen – my background

- Ph.D. in Computer Science from University of Bergen, Norway
- Worked in Silicon Valley for 25+ years, mostly in software startup companies and as a management consultant; managed every kind of technical organizations from Development through Professional Services (consulting)
- Extensive experience in IT business process re-engineering, managing software projects from inception through completion around the world
- The last several years, my work has focused on enhancing employment services and improving user experience for AI-powered ILMS's for governments

What a modern, country-wide ILMS should provide

Presentation to Trinidad and Tobago

Overview

- Lessons learned from Jamaica's current LMIS
- We will address 3 areas of an ILMS
    1. Job board – job matching, gap analysis, document parsing and classification
    2. Labour Market Information (LMI) – Real-time analytics, analytical tools, forecasting
    3. Infrastructure – cloud, scalability, availability, performance, privacy, security
- For each area, we will address
    a. Functionality needed
    b. Knowledge needed to create the necessary functionality
    c. The type of human resources with the necessary knowledge
- We then analyze options for the software
    - Buy-versus-build
    - Software-as-a-Service versus on-premise
    - The benefits of off-the-shelf software
- And reach a conclusion

Deficiencies of Jamaica's current LMIS

- No automatic matching, incorrect parsing of documents, no LMI
- Resources (articles, etc.) outdated or non-existing
- Not being used by job seekers or employers
- Built on Drupal 8 (a CMS), which is unsuited for the complex, data-intensive, and real-time processing demands of a modern ILMS.
  - Not designed for deep parsing and semantic extraction of unstructured text
  - Cannot manage and leverage sophisticated ontology for skills and occupation
  - Not designed for large-scale data processing and real-time analytics required for dynamic labour market information

Upgrading current LMIS is simply not viable

- Architectural mismatch – AI-driven matching, semantic understanding, real-time analytics and advanced data processing doesn’t fit into Drupal
- Prohibitive cost and complexity of retrofitting – integrating new AI/NLP engines, semantic framework, and real-time data pipelines would be expensive, time-consuming and carry immense technical risk
- Perpetual technical debt – trying to retrofit would create a patchwork of disparate technologies which is a maintenance nightmare; costly and fragile
- Inability to meet modern standards – an outdated architecture will struggle greatly to provide high scalability, robust cybersecurity, guaranteed availability, and compliance with data privacy and accessibility standards

1a. AI-driven automatic matching and parsing – 24x7

- Matching should be on skills/experience/etc. – not keywords
  - As soon as a job/resume becomes available it is immediately and automatically matched and communicated to job seeker/employer
  - Explainable match score – “73% match to job”, how each requirement match
  - Gap analysis – show how each gap can be closed by which training course(s)
  - Match “across” languages (English, French, Spanish, Dutch, etc.) so a resume from Jamaica can match a job in e.g., Dominican Republic
- Requires correct parsing of resume/job opening
  - To extract correct skills/education/occupations/etc. (entities)
  - Normalize skills to compare “apples to apples”
  - Correctly classify entities according to National/Caribbean Vocational Qualification, ISCO, ESCO, O*Net, etc.

1b. Requires deep knowledge of

- AI, ML, DL, neural networks, and knowledge graph construction (ontology)
- Ontology to understand context, nuance, and relationships between skills, occupations, industries, etc. (entities)
- Labour market dynamics encoded in the AI model
- Advanced multi-lingual NLP, parallel corpus creation, and maintaining linguistic models for all target languages
- Event-driven architectures and efficient background processing
- Custom semantic search engine, labour market-specific knowledge graph, and search relevance algorithms

1c. Human resources requirements

- Ph.D.-level AI/ML engineers, computational linguists, and ontologists to continuously train and update complex AI models
  - Complex scoring algorithms, integrating them with AI models, and creating a vast database of relevant training programs and their associated skills
  - Advanced AI/recommendation feature to automatic linking of training to gaps
  - Map multiple, evolving taxonomies into the ontology
- Expert-level NLP engineers, linguists, data architects
  - Parsing unstructured texts, graphical elements, normalization pipelines
- Experienced engineers in complex system design for real-time data ingestion, processing queues, notification services in order to ensure low latency and high reliability

➢The scarcest and most expensive tech resources on the planet

2a. Labour Market Information/Analysis

- Integrate external data sources (e.g., STATIN, NIS, HEART, UWI)
- Use data from the ILMS itself
- Real-time data analytics
  - For governments, job seekers, employers, and educators
  - Job/skill demands trends, hiring patterns, unemployment/layoff signals, etc.
- Analytical tools
  - For policy-making, program design, employer services and career guidance
  - Analyze job demand/supply, skills intelligence, education/training needs, etc.
- Forecasting tools
  - Anticipate future labour demand, skills gaps, and economic shifts
  - Occupation demand, skills gaps, education/training needs, wage trends, etc.

2b. Requires deep knowledge of

- Well designed, secure, and versioned APIs
- Sophisticated dashboards, reporting tools, and real-time analytical capabilities
- Econometrics, statistical modeling, ML for time series analysis
- Model validation and recalibration
- Advanced forecasting models (powered by AI)

2c. Human resources requirements

- API engineers/developers and technical writers
- Business intelligence developers, data engineers, UI/UX designers
- Engineers to build a robust streaming architecture

➢Possible to get, but several needed

3a. Technical infrastructure for the new ILMS

- Cloud solution
- Mobile-first ILMS, need to work with 3G, 4G, as well as 5G
- Scalable, high-availability, performant, secure
- Compliance and regulations, data protection for security and privacy
  - GDPR, EU act on AI, XAI and/or IAI, etc.
  - ISO 27001, SOC-2, etc.
  - Accessibility for people with disabilities (WCAG, ADA, EAA, etc.)
- Use APIs to connect labour market data sources (e.g., CSO – Central Statistical Office, NIBTT, MPD) to the new ILMS

3b. Requires deep knowledge of

- Scalable database technologies, storage infrastructure, big data environments (e.g., data warehousing, data lakes)
- Cloud architecture, cybersecurity, site reliability engineering
- Mobile application development, responsive web design, etc.
- Complex data privacy laws (for GDPR), privacy-by-design, legal monitoring
- External audits, policy development, security controls (for ISO 27001)
- Inclusive design practices and accessibility expertise
- EU AI Act legislation – transparency, human oversight, data governance

3c. Human resources requirements

- API engineers/developers and technical writers
- Business intelligence developers, data engineers, UI/UX designers
- Engineers to build a robust streaming architecture
- Cloud architects, cybersecurity experts, SREs
- Mobile app developers, responsive web design engineers
- Experts in privacy-by-design principles, implementing legal reqrmnts.
- Multi-year, resource-intensive development/adherence of processes
- Specialized accessibility experts, experts in inclusive design practices
- Experts in ethical and technical AI

➢Highly specialized and expensive resources

Why compliance is important

- The **legal** (and **reputational**) **risk** of non-compliance with security (e.g., ISO 27001), privacy (GDPR, Data Protection Act of 2011), accessibility (e.g., WCAG) – and future legislation on AI – can be **immense**

Buy-versus-build (software only)

Feature/aspect	Buy	Build
Risk level	Lowered; proven solutions	High; significant risk of delays, cost overruns, failed implementation
Initial cost	Lower upfront cost	High upfront cost
Total cost of ownership	Predictable	High and continuous; unpredictable long-term costs
Time to deploy	Fast; 3 to 12 months	Slow; 5 to 10 years
Complexity & core functionality	Built-in; rich, proven complex functionality	Immense challenge; must be developed from scratch
Customization	Configurable and extensible	High theoretical control; great dev and maintenance overhead
Expertise needed	Low; vendor managed	High; in-house or contracted tech expertise
Maintenance & support	Included in agreement	High & continuous; Ministry fully responsible

Buy-versus-build (software only), cont.

Feature/aspect	Buy	Build
Scalability, performance, high availability	Built-in and elastic	Challenging & costly; Ministry fully responsible
Security & compliance	Enterprise-grade & built-in; Ministry resp for data usage and access	Ministry carries full responsibility; high risk
Vendor lock-in	Possible; long-term reliance on vendor	No vendor lock-in; dependent on in-house and contracted expertise
Innovation & future proofing	Continuous innovation; regular updates from vendor	Stagnation risk; must be planned and funded internally

- Buy is lower risk, lower cost, faster to deploy
  - The strategically sound and fiscal responsible choice
- Build is high risk, higher cost, years to deploy (5 to 10 years)
  - An almost insurmountable challenge

Software-as-a-Service versus on-premise

Aspect	SaaS	On-premise
Initial setup & infrastructure	None to minimal	Significant upfront investment; HW & SW
Ongoing maintenance & operations	Included; vendor responsibility	Ministry responsible; must build, host, and maintain
Scalability & performance	Elastic & optimized; vendor SLAs	Challenging and costly; HW and monitoring
Reliability & Disaster Recovery	Build-in & guaranteed	Complex & costly; HW & SW
Staff requirements	Minimal; focus on BPO and user support	High demand for specialized staff

- ➢SaaS is lower risk, lower cost, faster to deploy
  - The strategically sound and fiscal responsible choice
- On-premise is high risk, higher cost, long time to create
  - Unsustainable burden of cost, complexity, and risk

Advantages of SaaS off-the-shelf software

- Fastest time-to-value/go-live
- Used by numerous clients, software more robust and stable
- All updates and features received simultaneously, ensuring the system remains current with the latest technological advancements
- Use a supplier that offers configurability and robust, open APIs
  - ✓Get benefits from SaaS fundamentals (speed, scalability, performance, etc.)
  - ✓Can achieve critical customization for unique national requirements
  - ✓Enables integration for local needs

Conclusion

- The overwhelmingly more pragmatic, financially responsible, and strategically advantageous choice for a complex ILMS that serves the entire nation is therefore a

Cloud, Saas, off-the-shelf solution

- It allows the ministry to leverage global expertise, predictable costs, and continuous innovation, enabling it to focus on its core mission of effectively managing the labour market for its citizens

Example: countries are choosing off-the-shelf

- When Norway did a total revamp of their job board, they chose to go with an off-the-shelf supplier
- This is not due to lack of resources
  - 5.5M people, #2 on Human Development Index, US$ 89,154 GDP per capita
  - NAV (the Norwegian Labour and Welfare Administration) has 22,000 employees, 15,500 as part of the state, 6,500 at the local NAV offices
- But realizing building and maintaining such complex software is not their core strength and is better left to experts whose only job is to build all aspects of an ILMS

Appendices

Jamaica's high-level requirements for an ILMS

- AI-driven matching
- Semantic matching based on skills/experience/occupation/education/ etc. (not string searches)
- Match score for resume to job posting and vice versa, with an individual match score for each requirement in the job posting
- Gap analysis with automatic matching for training/education to narrow/close the gap
- Match across languages, e.g., the ability to match a resume in one language with a job opening in another language
- Automatic matching and notification when a new or updated resume/job opening is posted to the ILMS
- Semantic search for job openings/job seekers
- High-precision parser to extract all entities (skills, education, background, etc.) from job openings, resumes, cover letters, certifications, etc.
- Ability to parse complex documents (e.g., multi-column, containing graphical elements)
- Normalization of extracted entities (e.g., skills, education, job titles)
- Classify extracted entities to public, standard classifications or taxonomies like ESCO, ISCO, O*Net, etc., but also to local classifications like National Vocational Qualification, CVQ, etc.
- Ability to provide several different classifications of the same dataset without having to do a massive re-classification of the entire dataset.
- Open, contemporary, documented APIs, normally RESTful APIs
- Ability to store large amounts of LMI data
- Analytical tools
- Real-time data analytics
- Forecasting tools
- Career guidance services
- Cloud, Software-as-a-Service (SaaS) solution, preferably off-the-shelf solution
- Scalable, performant, secure, and high-availability solution
- Mobile-first solution, works with 3G, 4G, and 5G
- GDPR compliant (or at least compliant with Jamaica's Data Protection Act, 2020)
- ISO 27001 compliant and/or SOC-2 compliant and/or equivalent certification compliant solution
- WCAG, ADA, EAA, Section 508, and AODA compliant solution
- EU AI Act compliant, XAI and/or IAI solution

HW cost for on-premise ILMS – ballpark only!

- Servers:
  - Application, database, web, backup/recovery servers: US$ 500K - US$ 3M+
- Storage:
  - SAN/NAS systems, backup storage: US$ 300K – US$ 1.5M+
- Networking equipment:
  - High-end routers and switches, firewalls and security appliances, load balancers, intrusion detection/prevention systems: US$ 200K – US$ 1M+
- Data center infrastructure (for on-premise):
  - Racks, UPS, generators, cooling systems, environmental monitoring systems, physical security: US$ 500K – US$ several million (upgrade or new)
- Other hardware:
  - Workstations/terminals, printers, scanners, etc.: US$ 50K – US$ 200K
- Total ballpark: US$ 1.5M – US$ 7.5M+
- Not counting: SW, implementation, maintenance, personnel, DR site, etc.