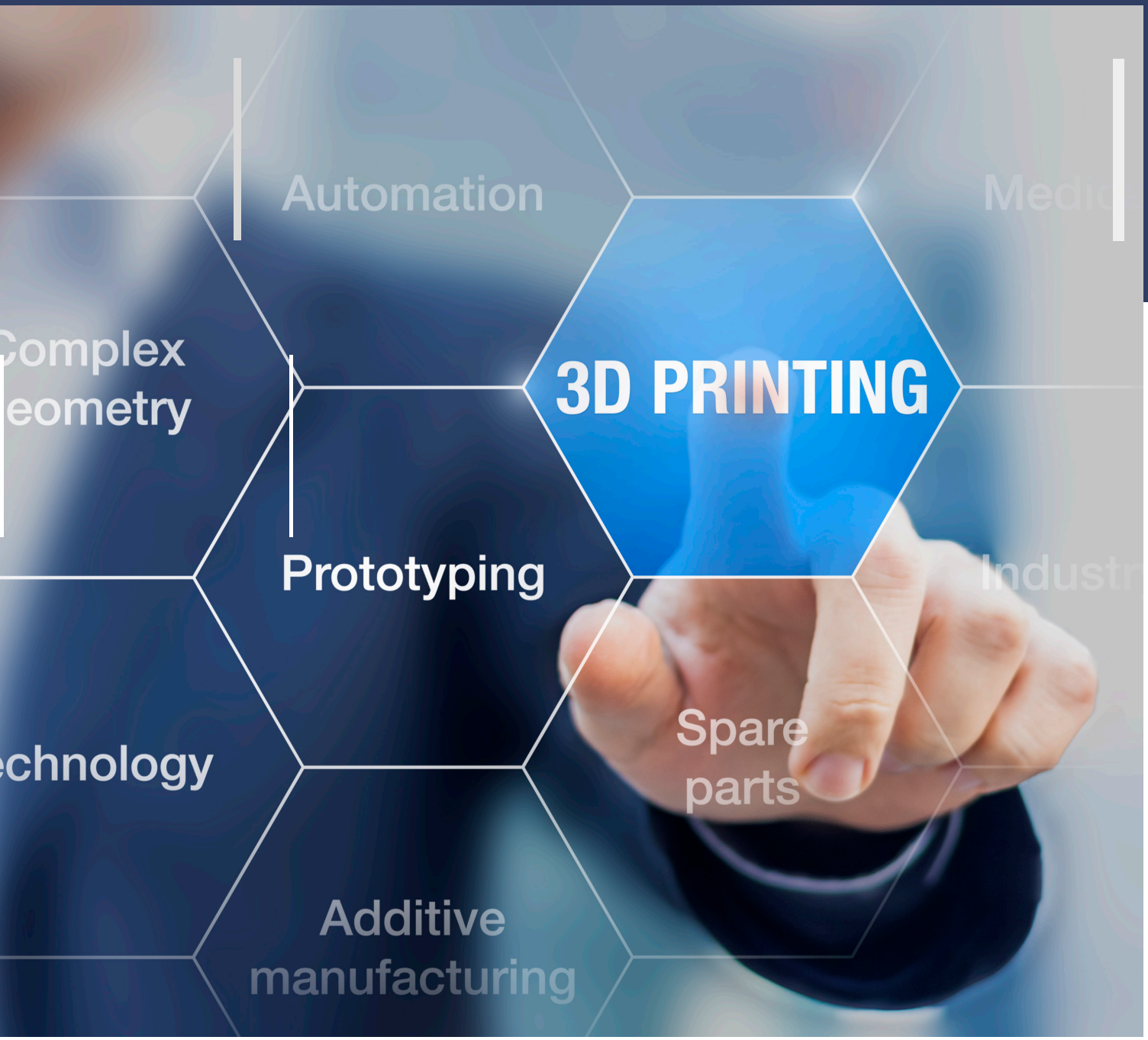
SAMUEL


# An intelligent platform for additive manufacturing

Success story

**Additive manufacturing (AM), often known as 3D printing, has moved far beyond rapid prototyping: it builds real, functional parts in metals and polymers directly from digital designs, layer by layer. In Europe, this transformation is accelerating; the 3D printing market was valued at around US$ 6.8 billion in 2025 and is forecast to more than double to US$ 13.2 billion by 2030, driven by hardware innovation, 'manufacturing-as-a-service' models, and strong uptake in automotive, aerospace, and healthcare sectors. Meanwhile, Canada's own additive manufacturing sector is surging: from roughly US$ 1.7 billion in 2023 to an expected US$ 6.7 billion by 2030.**




Yet, adoption is not without hurdles. High capital expenditures, material cost, and the need for specialised skills still limit full-scale implementation, especially for smaller organisations. Much of the knowledge remains in the hands of experts who have developed experience directly on the shop floor. Although AM is inherently data-driven, no safe mechanisms existed - at the start of the SAMUEL project in 2019 - to extract, valorise and monetise data from heterogeneous, separate data sources, while preserving intellectual property (IP) rights.

For companies considering AM, particularly SMEs, this made it difficult to identify the right technologies and applications for their 3D printing needs. There was no common place to find this information. Combined with the high cost of entry, many new players were hesitant to invest, ultimately hindering AM market growth.

### Empowering users through AI and knowledge sharing

SAMUEL brought together eight project partners from Belgium and Canada to address this challenge. Its main objective was to provide AM users with knowledge and to assist stakeholders across the AM workflow, making the process more consistent, reliable and efficient.

The key idea was to use a company's past 3D-printing data to work smarter. Thanks to the data, AI can predict things like the best way to print a part or how long it will take. At the same time, shape-based search tools allow users to find and reuse similar parts they made before. This combination reduces the risk of part failure and prevents underquoting, leading to better performance and cost control.

*SAMUEL represents a world-first achievement: prior to this project no tools existed that could use a company's own AM knowledge and past experience.*

**Project start**
September 2019

**Project end**
November 2022

**Project leader**
Alain Coulombe
3DSemantix, Canada

**More information**
https://itea4.org/project/samuel.html

SAMUEL also helps contractors navigate the AM landscape via a web platform that allows users to privately upload designs and automatically locate the most experienced AM suppliers. By finding manufacturers who have produced similar parts, costs are reduced and quality is maximised. While this disruptive AI platform targets the AM sector, it holds strong potential for expansion to other manufacturing fields such as machining or molding.

## Building on experience and technology

The project's core philosophy is that a company's AM experience resides within its printed 3D models. SAMUEL's technology is therefore built on three key pillars: AI, 3D model analysis and data collection.

For the latter, Cr3do - an additive manufacturing SME - has developed a machine-agnostic solution that captures AM production data through external sensors. These sensors monitor the build process in real time, detect printing errors, and can automatically stop layering to avoid unnecessary material waste and lost production time. This capability is reinforced by an automated design check tool that performs Design Rule Checks on 3D models prior to printing, identifying potential issues at an early stage. As a result, errors that previously led to failed builds, late-stage detection in post-production, and prolonged reprints have been almost completely eliminated. Time spent waiting idle has been cut by a factor of four, compared with earlier workflows in which multiple team members could remain inactive for hours while reprints were completed. In parallel, the automated selection of appropriate printing technologies during the quotation phase now requires minimal input from the production team, significantly shortening lead times and enabling faster delivery of higher-quality products.

Materialise, meanwhile, developed AI tools that can predict how long a print job will take, helping companies plan, price, and optimise their work more accurately, particularly within its healthcare and industrial 3D printing software solutions. So far, several proofs of concept (POCs) have been introduced and are now being prepared for production. It is expected that implementing these POCs will lead to faster, more automated build preparation and reduced waste.
The old Build time estimation is now replaced by the "SAMUEL" version with improved accuracy. Moreover, Materialise continues to invest in this field and is now leading a new ITEA 4 project, Valid3D, aimed at quality assurance and generative design in metal 3D printing. In Valid3D, the linking of all available process data (design, material, process monitoring and testing) is also enriched with virtual test methods such as

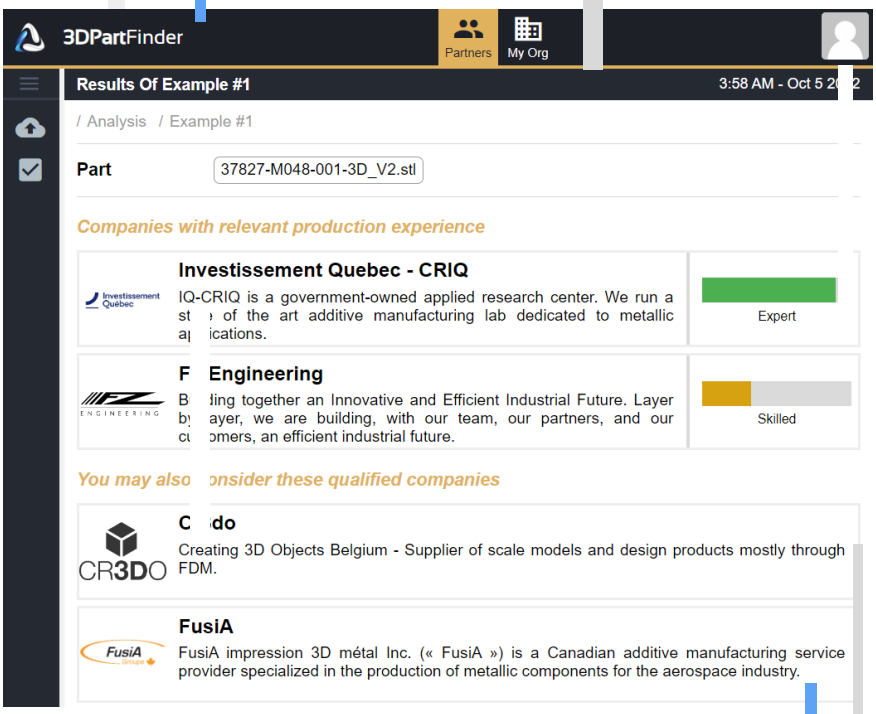
simulations. This broad database is used to develop AI models, which can be used to provide feedback to the individual process steps.

During the project, the partners also created new automated solutions for preparing print jobs, monitoring print quality, recognising parts, and setting up prints using machine learning. 3D model analysis and 3DPartFinder shape-based search played an important role in these developments. 3D model analysis is also the basis for 3DSemantix's AM partner search platform, which is one of the two solutions developed by 3DSemantix, together with Investissement Québec – CRIQ, Fusia, FZ Engineering and Tekna. The tool helps users find manufacturers with experience making similar parts or working with specific materials. It uses an AI model that compares a user's 3D design with past production data from different manufacturers to find the best match. 3DSemantix has signed a partnership with MoovinV, a leading raw material marketplace and agile sourcing, to offer search for Manufacturers based on their experience on the targeted design/material. The second solution is a costing tool for additive manufacturing that finds previous 3D-printed parts and their production data. It helps users sort through the vast amount of historical production data to identify highly relevant information they can reuse to estimate cost accurately. It also encourages companies to organise their data more effectively. 3DSemantix has signed a partnership with TopSolid, a leading CAD/CAM software editor, to offer this solution to their customers.

Importantly, SAMUEL can analyse and index 3D shapes without ever exposing the actual designs, so companies can share knowledge without risking their intellectual property. These developments together create a powerful, advanced toolkit for additive manufacturing.

## A world first to leverage AM knowledge and expertise

SAMUEL represents a world-first achievement: prior to this project no tools existed that could use a company's own AM knowledge and past experience. This opens the door to new technical possibilities and new business opportunities.




Search result of 3DPartFinder partner search platform

Machine learning models for build time estimation, for example, achieved estimation error rates below 10% (and below 5% in many cases). Improvements have also been observed in the AM process itself, with design guidelines and sensor-based monitoring contributing to a 67% reduction in design errors and an approximately 20% reduction in manufacturing errors. These figures are expected to evolve further as the project moves into commercialisation.

## Business impact and market potential

SAMUEL helps companies reduce costs by providing easy access to the most efficient and cost-effective 3D printing options. This makes it easier for small and medium-sized businesses to start using AM, opening new opportunities and supporting the growth of the global AM industry. Since about 75% of companies still don't use AM in their production, there is huge room for expansion. Early adoption of SAMUEL's results will help companies to improve their competitiveness in this fast-growing field.

SAMUEL is now in the process of dissemination and platform expansion with new partners. 3DSemantix has already partnered with leading CAD and PLM editors and distributors in order to provide the best integration for 3DPartFinder, and is welcoming new partners. Two leading Aerospace Manufacturers working with several hundred Part Manufacturers will be testing the capabilities of the platform to find manufacturers with experience in AM and Machining processes. For AM and Machining suppliers, using the platform increases visibility and potentially market share.

The toolkit also helps companies reuse internal knowledge, create more accurate price quotes, and keep valuable expertise even when experienced staff members leave. With strong data management systems now in place to protect design files and production data, the next step is to turn this data into useful insights using AI. Companies that adopt this approach early will gain an advantage, supported by SAMUEL's tools for additive manufacturing. The ITEA project Valid3D has emerged from SAMUEL's success and more collaborations in this field are to come!