SAMUEL

An intelligent platform for additive manufacturing

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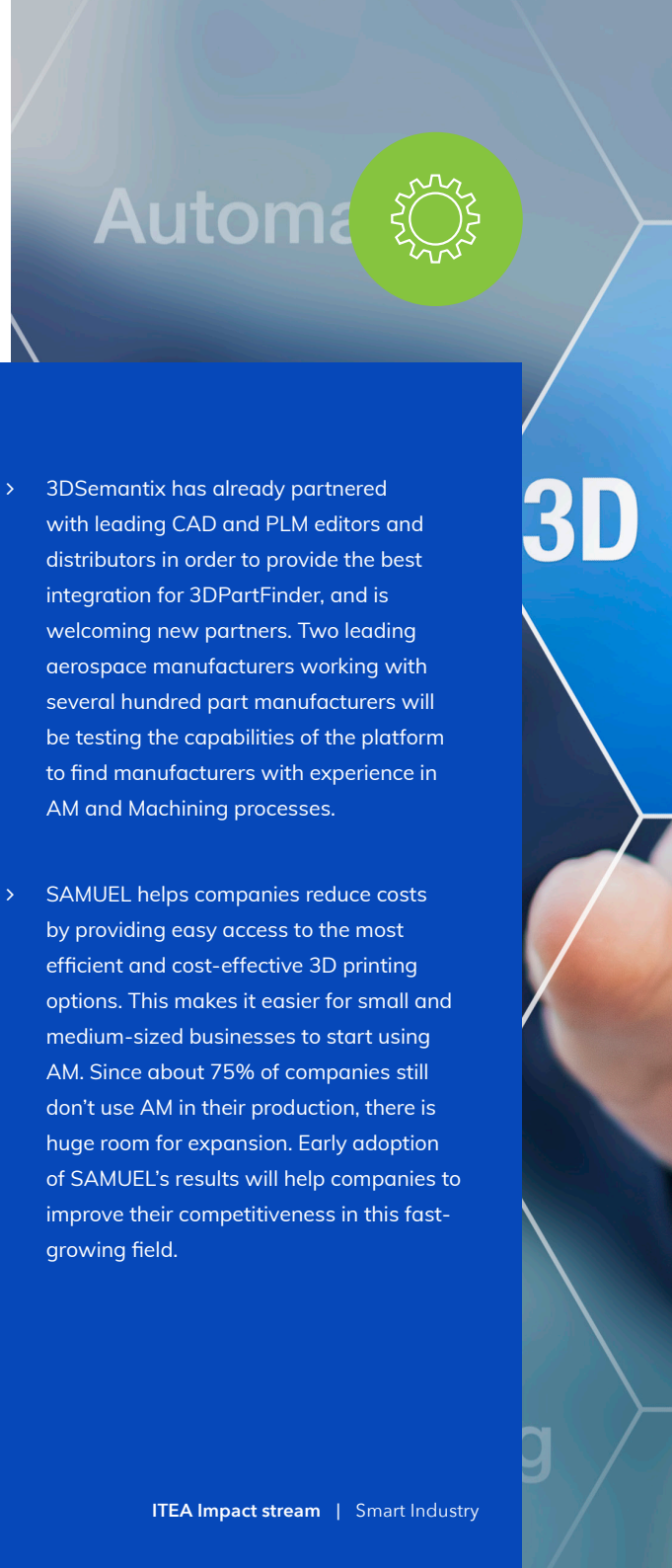
Additive manufacturing (AM), often known as 3D printing, has moved far beyond rapid prototyping: it builds real, functional parts in metals and polymers directly from digital designs, layer by layer. Yet, adoption is not without hurdles. High capital expenditures, material cost, and the need for specialised 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.

SAMUEL was set up 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.



Impact highlights

- 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.
- Machine learning (ML) models for build time estimation, developed in SAMUEL, achieved estimation error rates 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.
- For Cr3do, errors that previously led to failed builds, late-stage detection in post-production, and prolonged reprints have been almost completely eliminated, thanks to the results of the SAMUEL project. 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.
- 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.
- 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. 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.

Project results

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 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.

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.
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.
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 second solution is a costing tool for AM that finds previous 3D-printed parts and their production data.

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 AM.

Exploitation

Based on the developments in the SAMUEL project, Materialise has introduced several proofs of concept (POCs) which are now being prepared for production. Moreover, Materialise continues to invest in this field and is now leading a new ITEA project, Valid3D, aimed at quality assurance and generative design in metal 3D printing.
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. In addition, 3DSemantix signed another partnership with TopSolid, a leading CAD/CAM software editor, to offer its other solution to their customers.
SAMUEL is now in the process of dissemination and platform expansion with new partners. 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.

SAMUEL

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PROJECT LEADER CONTACT

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PROJECT START

September 2019

PROJECT END

November 2022

PROJECT WEBSITE

https://itea4.org/project/samuel.html

PARTNERS

Belgium		*Canada*	
Cr3do	⊙	3DSemantix	⊙
Materialise	●	Centre de Recherche Industrielle du Quebec	○
SIRRIS	○	FUSIA	⊙
		FZ Engineering	⊙
		Tekna Plasma Systems	⊙