InnoSale

An AI-based approach to variable product sales

Through the integration and development of technologies such as rule-based reasoning, artificial intelligence (AI) algorithms and fuzzy logic, the ITEA project InnoSale (Innovating Sales and Planning of Complex Industrial Products Exploiting Artificial Intelligence) revolutionises the sales offer creation process for complex system configurations, thereby reducing manual work and the duration of sales processes while optimising prices.

The sales offer creation process is inherently complex due to the involvement of multiple stakeholders and the need to define the right price based on numerous product configurations. Customised products need significant back-office support and around 40% of today's products require manual work. Although historical data is already used today, missing integrations, insufficient accessibility, different file formats and a lack of awareness prevents the full exploitation of its value. Through these factors combined, offer creation typically requires the presence of highly skilled sales experts who can engage in such an intricate and time-consuming process.

InnoSale innovates sales systems and processes for complex, variable industrial equipment, plants and services that require time-consuming back-office support. The use of validation rules and case-based reasoning allows the InnoSale system to suggest relevant purchase options. In addition, the use of evolutional clustering allows sales experts to find previous customer requests, orders and other suitable solutions by identifying similarities between customers. To achieve this, the project introduced an extensible application design (including a knowledge acquisition component and inference engine to support different types of logic for data evaluation) and more powerful logic systems to integrate previously unchecked options into validation rules. This enables a smarter strategy for systematic pricing, as more

relevant information is considered using the rule-based formalisation of human experience and AI-based data analytics.

Required reasoning, e.g. using product variations, is enabled by Nemo, an open-source inference engine that is faster and more memory-efficient than alternatives while offering flexible features to support quantitative reasoning and various data types. This also includes a web interface to run the engine in the browser and allows users to trace how conclusions are reached.

⌃ Innovating sales and planning

Technology applied

A major innovation of InnoSale is the combination of AI prediction and fuzzy logic to enable optimal pricing. Using a neural network, the system is trained using publicly available data (such as OECD studies) and company internal information to predict future trends in costs and sales. This predictive model uses historical data and statistical analysis to provide a combined price prediction of a combined product, queried via a product matrix. Once this prediction phase is complete, fuzzy logic rules are applied to determine the final price – the customer's price.

These developments are supplemented by various system and user interfaces, such as a fuzzy logic rules editor to allow businesses to set formal pricing rules or a text mark & bind component that extracts data from emails and automatically populates this in forms while identifying gaps. InnoSale then demonstrated its approach in four use-cases that highlight a diversity of applications: (1) materials handling, focusing on both industrial cranes and light lifting components; (2) software market, which uses learning techniques, similarity analysis and consumption pattern to offer a

software solution for digital products; (3) automotive, proposing a similarity analysis of products during the sales process; and (4) waste management, demonstrating the product sales process.

Making the difference

In using AI to support the sales effort and product configuration, InnoSale is unique both in ITEA and beyond. For materials handling, for instance, no IT solutions exist on the market to support the full sales process. The project's initial impact is thus the validation that such an approach can be impactful on many domains. In nine demonstrators across the use-cases, InnoSale has shown that its technology can help to reduce the number of products that require back-office support from 80% to 58% and the number of manual inputs for product configuration by 33%. For both buyers and sellers, the main benefit lies in a reduction of the sales process duration by 32% and the average bidding time for industrial products by 25% – all while determining the most competitive price.

For the consortium, involvement in the project has so far led to 13 new hires and 18 conference publications or exhibition presentations. To showcase their work from a research perspective, components like the fuzzy logic engine, AI price prediction, inference engine and user interfaces have also been made open source. In addition to making future commercial modules easily accessible, this will help to disseminate the novel nature of their validation in numerous areas and will open the door to further development in new domains, including use by third parties.

The future

Regarding commercialisation, efforts are now underway to exploit five independent modules developed in the project. These will be used to improve existing products, reutilise components developed in an industrial context, and broaden the partners' customer bases in domains that stand to benefit the most from AI-based price optimisation. There is huge movement across the markets: as the global manufacturing and wholesale market, for instance, is expected to grow from USD 44 trillion in 2023 to over USD 63 trillion by 2030 and could use InnoSale's results to tackle fluctuating material costs, demand variability and complex pricing strategies. This is just one example among many rapidly developing fields, providing InnoSale with enormous potential long after the project's conclusion.

Major project outcomes

Dissemination
› 8 publications
› 5 presentations at conferences/fairs

Exploitation (so far)
New services:
› Fuzzy logic engine - a method to apply fuzzy set theory and fuzzy logic rules to determine the sales price of a product by considering various price influence factors.
› Factory Load Provider Configurator - Allows production managers to monitor and estimate future factory load by providing a predictive and configurable view of projected capacity.
› AI price prediction - Price Optimization which helps companies to set the right price and allows them to be more agile, responsive, data-driven, and formalism-based in their decision-making.
› Nemo inference engine – a new inference engine which is running in the browser ("serverless") and outperforms existing solutions on the market.

New systems:
› SUI methodology (Short specification; functions on User level; functions on Implementation level) - method for identification of synergies on software implementation level

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Partners

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› Ermetal otomotiv ve esya sanayi tic.a.s.
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