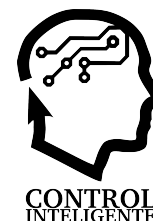




XVII Simposio CEA de Control Inteligente

27-29 de junio de 2022, León



Demand Model in an Automotive Supply Chain Company

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To cite this article: Freijo, Fernando, Lopez-Guede, Jose Manuel. Demand Model in an Automotive Supply Chain Company. 2022. XVII Simposio CEA de Control Inteligente.

Resumen

En este artículo exponemos la implementación de un proyecto de predicción de la demanda asistido por Inteligencia Artificial en una PYME (pequeña y mediana empresa) del País Vasco. La empresa pertenece al sector del recambio del automóvil orientada principalmente al sector profesional (B2B) siendo sus principales clientes, talleres de reparación de automóviles. Cuenta con ocho oficinas que gestionan un amplísimo catálogo de primeras marcas ubicadas a nivel internacional. En este contexto, la operativa logística supone una actividad clave del negocio. Por otro lado, el flujo de mercancías entre sus almacenes, la gestión de compras y los costes de transporte son también áreas a optimizar. Consecuentemente, la gestión eficiente del stock es fundamental para los resultados del negocio. En este artículo; proponemos un modelo de predicción de la demanda asistido por un algoritmo de aprendizaje automático que ayude a la toma de decisiones empresariales. La información tratada procede de varias fuentes de datos como son el sistema ERP, la plataforma B2B y la base de datos del call center. El objetivo principal de este modelo es incidir sobre un punto débil generalizado en todas las empresas de este sector.

Palabras clave: Gestión de Procesos de Negocio, Procedimientos de Planificación de procesos, Modelo de asistencia a la toma de decisiones empresariales, Programación de tareas y actividades, Integración de aplicaciones empresariales, Empresa Digital.

Demand Model in an Automotive Supply Chain Company

Abstract

This paper expound the implementation of a project of demand forecasting powered by Artificial Intelligence (AI) in a small and medium-sized enterprise (SME) situated in Basque Country. The company works in automotive after-market segment, whose main clients are professional Car Workshops. Eight offices handle a massive product catalogue supplied by international leadership manufacturers located all over the world. Considering this scenario, the logistic operative is evidently a key business activity. On the other hand, the flow of goods among their warehouses, the purchasing management and freight costs must be also optimized. This means that an efficient stock management is equally crucial for the result of the company. In this paper, we propose a demand prediction model assisted by machine learning algorithms which facilities crucial business decisions. The information gathering uses several sources such as the ERP; the B2B Platform and the call center Data Base. The main aim of this model is to reinforce a weak point detected not only in this company, but also in others competitor enterprises.

Keywords: Business Process Management, Procedures for process planning, Enterprise Modelling, Decision-making support, Job and activity scheduling, Enterprise Application Integration, Digital enterprise.

1. Introduction

Nowadays, AI is being applied to different knowledge areas (Dirican, 2015), especially in academic environments. Nevertheless, there are yet some issues to go through before all this progress reach the real economy and the industrial activity. In general, small and medium-sized enterprises lack economic resources and professional expertise to deal with these types of projects. Indeed, our approach takes a medium size particular company as starting point. Then, we implement a solution adapted to their specific necessity and finally, we will extend our result to other similar cases. Bear in mind that we will be able to generalize our research on condition we study a common problem in a specific sector.

2. Company Information

Our Company is a SME Company engaged to the automotive aftermarket attending more than 3,000 car workshops as main clients. The headquarters is lied in Etxebarri and they have seven offices around of the north of Spain. All of them have point of sales and warehouses.

Their commercial strategy is based on three sales channels:

- Telemarketing attended by a professional team.
- Direct sales in their 8 point of sales.
- On line sales: The Company boasts a B2B e-commerce platform where the clients can make orders in an efficient and agile way. Undoubtedly, it is the channel more promising with an accelerated growth in the last years.

The company is capable of delivering a product within 30 minutes after the customer makes the order. According to the opinion of their clients, this service is the most highly valuable. It means they must have an efficient system of distribution supported by an appropriated sized transport fleet.

To sum up, the company works in the professional market of the automotive supply chain. Consequently, Logistic Operative and Stock Management are the essential keys of this business, so, these are the main areas to address our project.

3. Supply Chain and AI Applications in Logistic Area

A Supply Chain refers to the network of companies that produce, sell and deliver product o services to a particular market (Icarte, 2016). The agents of this chain include Manufacturers, Suppliers, Warehouses, Retailers, Transport Companies among others. There is a wide range of opportunities to apply AI for the Logistic Function (Leporati, M., et al., 2019).

Deep Learning Algorithms and Expert Systems deal skillfully with scenario analysis and numerical analytics, both of which are crucial for logistic planning (Dilmegani, C., 2020). Smart warehouses (Zhen, et al., 2022) evolves rapidly with the integration of Autonomous Mobile Robots (AMR), (Li, et al., 2019) Automatic Guided Vehicles (AGV), (Correia, et al., 2020), Machine-Learning Techniques and Computer Vision Technology (Anhong Guo et al., 2015). The models of Route Optimization use algorithms to find the shortest and efficient ways for logistics movements (Paternina-Arboleda, C., et al., 2019). The predictive maintenance (Gama, J. et al., 2020) is improving significantly thanks to projects of IoT,

sensor development and Big Data Analysis. Customer service is a vital matter in logistics companies and the chatbot solutions handle quite dexterously some call center tasks (Albrecht et al., 2021). AI is an useful tool for demand prediction as well as enable data analysis in real time reducing errors significantly. The dynamic price system (Dube, et al., 2002) adjusts constantly the figures to the real demand. The respond to this fluctuation can be more accurate using machine-learning algorithms to analyse the market changes.

4. The European Strategy concerning Digital Transformation.

The European Commission is leading an ambitious plan for the Green and Digital Transformation (European Commission, 2020) in all the European territory. In this context, we can say that the project is closely aligned with the European political. For example, part of the EU plan is the Digital Europe Programme whose main objective is “bringing digital technology to businesses, citizens and public administrations”. This year a budget over €7.5 billion is available to boost in five key capacity areas: Supercomputing, Artificial intelligence, Cybersecurity, Advanced digital skills, and ensuring a wide use of digital technologies across the economy and society, including through Digital Innovation. According to the digital strategy of the EU, this plan “aims to accelerate the economic recovery and shape the digital transformation of Europe’s society and economy, bringing benefits to everyone, but in particular to small and medium-sized enterprises”.

5. The Demand Prediction Project

5.1 Previous works

In order to detect the key constraint of the daily operative of this business, we made previously a consulting plan project whose main output was a Digital Plan. This document is the basic supporting document for the final implementation of our solution. It is important to remark that because of this consulting process, we obtained a considerable number of actions to take, making this Digital Plan a more ambitious project that we expound on this paper.

Below we mention the stage of this consulting project:

- S-1: Analysis of the initial situation of the company's Business -Processes, including their main KPI's.
- S-2: Description of the company's Strategy.
- S-3: SWOT analysis of processes.
- S-4: Enumerative analysis of digitization projects, with the technological evaluation of the alternatives.
- S-5: Selection of Projects, considering the situation of the company and the market.
- S-6: Description of each project, including necessary resources, cost, technology, specific systems and planning.
- S-7: Sequenced Action Plan of the proposed digital itinerary.

5.2 The Demand Prediction Problem

In this business, the stock levels and the sale price along with their correlations are factors that determine to a large degree the result of the company. Both parameters require a

deep analysis of available data. However, the traditional method to manage stocks as well as to estimate the right sale price result notoriously inefficient.

The stock replenishment depends on many variables such as the future demand, acquisition prices, available merchandises, purchasing volume discounts, and the regional vehicle fleet, among others. Some of them are not easy to know. On the other hand, a product out of stock means an inadmissible opportunity cost. At the same time, although the sale price is limited by the market, it must guarantee a trade margin.

When new manufacturers offer our company the distribution of their catalogue, the Management studies the proposed agreement and make a decision about the incorporation of these products. In this case, an accurate information is crucial to reach a mutual beneficial agreement.

5.3 Prediction model

Our study concluded that an adequate solution is a model of demand prediction which handles historical company data along with information from external big impact factors. Indeed, this model collects information from several data sources such as the ERP, call center and B2B Platform.

The stage of this project are implicit in the Data Life Cycles model that is shows below.

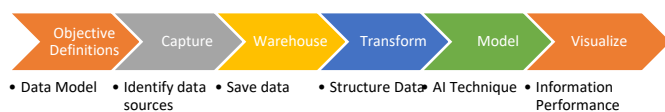


Figure 1: Data Life Cycle, <https://pipelab.es/>

An initial process of technology watch concluded that multiple methodologies have been tested in demand forecasting. In fact, it is possible to find in the market several competent software that implement methodologies related to AI. Nonetheless, neither of them was considered an appropriated solution for this case.

6. Conclusion

In this paper, we describe the implementation process of an IA Solution for a company working in the Automotive Supply Chain. In a bottom-up approach, we study weak points of this business and design an appropriated solution to deal with. In detail, we develop a demand forecast model supported by IA Algorithms. This expert system proposes an efficient stock management including purchasing decision and sales prices configuration. The system inputs is a set of variables from multiple information sources such as ERP, B2B System and Call Center data. Having studied commercial software and different cases of technology application in Supply Chain, we conclude that our model responds more effectively to the objective of this particular sector.

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