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Forecasting Supply Chain Demand Approach Using Knowledge Management Processes and Supervised Learning Techniques

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ABSTRACT

In today's context (competition and knowledge economy), ML and KM on the supply chain level have received increased attention aiming to determine long and short-term success of many companies. However, demand forecasting with maximum accuracy is absolutely critical to invest in various fields, which places the knowledge extract process in high demand. In this paper, the authors propose a hybrid approach of prediction into a demand forecasting process in supply chain based on the one hand, on the processes analysis for best professional knowledge for required competencies. And on the other hand, the use of different data sources by supervised learning to improve the process of acquiring explicit knowledge, maximizing the efficiency of the demand forecasting, and comparing the obtained efficiency results. Therefore, the results reveal that the practices of KM should be considered as the most important factors affecting the demand forecasting process in supply chain. The classifier performance is examined by using a confusion matrix based on their accuracy and Kappa value.

KEYWORDS

Forecasting, Knowledge Management, Machine Learning, Prediction Models, Supply Chain Decision Support Systems, Supply Chain Management

INTRODUCTION

Over the last years, a Supply Chain Management (SCM) framework was presented as a new business model and a way to create competitive advantage by knowledge discovery from heterogeneous data of customers and suppliers. Similarly, SCM has become increasingly significant with the globalization of business, and competition (Silva et al. 2020; Ketchen & Guinipero, 2004). Typically,

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SCM has been widely recognized as a significant point for information technology investment in supporting supply chain processes (Tooranloo et al. 2018; Wu & Chuang, 2010). In the literature of supply chain management, multiple authors present various definitions. According to (Raghunath & Devi, 2018), SCM is about managing flows of material, information, and funds in a complex network of entities of suppliers, manufacturers, distributors, and customers. For Gonzalez-Loureiro et al. (2015), the supply chain is a set of activities that span enterprise functions from the ordering and receipt of raw materials through the manufacturing of products through the distribution and delivery to the customer. Additionally, SCM is defined as a set of entities directly involved in the activities associated with the upstream and downstream flows of products, services, finances, and/or information from a source to a customer (Aggarwal et al. 2020; Christopher, 2016; Islek & Oguducu, 2017). For Kong & Xue, (2013), SCM is a mode of operation which is new, advanced, and could improve the business competitiveness. Additionally, the supply chain is the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer (Mentzer et al. 2001). At the same time, a supply chain can be regarded as a complex network spanning several companies and sectors. This latter has involved keeping extensive records of almost every aspect of its activities. Therefore, the success of a supply chain depends on the accuracy of the forecasts, especially those of the demand. According to (Stadtler & Kilger, 2008), Supply Chain Management (SCM) is defined as, the act of sharing material, information within organizational units, so as to meet customers' needs and as a result, enhance the entire supply chain involved. In the industrial world, (Mohseni et al. 2019) show that a strong there is no way for the industry to escape the adoption and to incorporate sustainability in SCM. Hence, it is needed to specify sustainability practices in SCM in accordance with industry characteristics.

In order to achieve the required supply chain, it is necessary to use intelligent technologies and tools namely Machine Learning (ML) which enables monitoring, evaluation of supply chain performance and anticipates the future. In this regard, Machine Learning (ML) has been one of the most promising technologies due to its multiple capabilities important for business success in terms of making accurate predictions, recognizing patterns, etc... In recent years, a number of practical logistic applications of Machine Learning (ML) have emerged, especially in SCM. Besides, Machine Learning techniques constitute a real asset for supply chains, since they give better forecasts than the more traditional approaches. As per our objective, the combination of ML methods and supply chain management concepts can improve supply chain efficiency and reduce costs with an optimized decision-making process by providing actionable information to the right decision-makers.

Currently, Knowledge Management (KM) process has been convincingly applied to some extent in logistics management, forecasting/demand planning, scheduling, inventory management, humanitarian logistics, and reverse logistics. Moreover, the demand knowledge derived from obtained data and factors knowledge which influence on it allow to manager to react more flexibly on-demand change, to plan more effectively, to increase the availability of products on the market, to increase the level of customer's services and to develop this competitive advantage. In most studies, knowledge sharing has been extensively studied as a key enabler for coordination and integration in supply chains in order to demonstrate its relevance and applicability for practitioners (Kiil et al. 2019; Posey & Bari, 2009).

In the same way, the forecasting concept is the news logistic concept that increases the potential of a global logistics solution through global interconnectivity stakeholders especially the connection among manufacturers, distributors, and consumers in the chain (Kantasa-ard et al. 2019). Apparently, forecasting is essential in investment, which places machine learning in high demand. In prior studies, various time series forecasting models have been widely applied in sales forecasting, such as exponential smoothing models, ARIMA models, expert systems, and Nearest Neighbors models. A case study carried out by (Annor-Antwi et al. 2019), illustrates that forecasting helps in the future prediction of the market trends, it also helps a business utilize resources more efficiently, manage inventory, remain competitive, evaluate its past and therefore be able to have a clearer focus on the