MACHINE LEARNING :

WHAT ARE THE APPLICATION FOR SUPPLY CHAIN ?

Certain «trendy» words convey a lot of modernity and enthusiasm. This is the case for "blockchain", "Machine Learning", "IoT" and even "cloud", which are often qualified as "buzzwords" and whose outlines, definition and application cases are not always easy to discern.

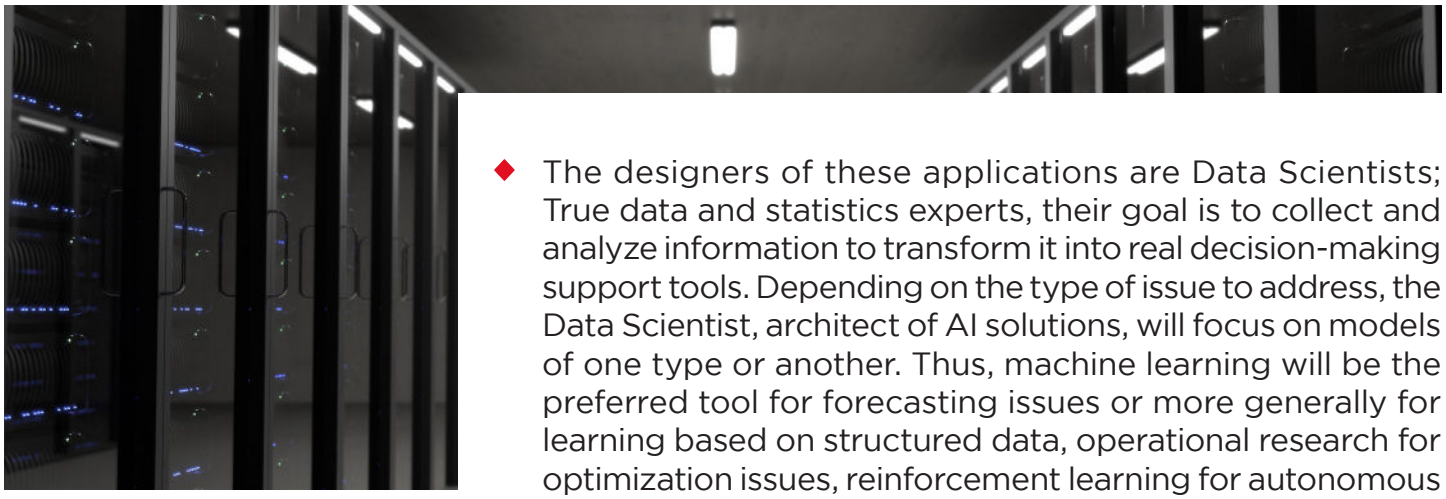
Artificial Intelligence also plays a highly acclaimed role in these technologies. What is it all about? How will it make it possible to substantially improve the Supply Chain processes? What levers, until now out of reach, will thus become available? A true development opportunity or a simple marketing ploy?

These are all questions that AI must address to ensure its credibility and demonstrate the relevance of its use in the context of the Supply Chain.

AI & MACHINE LEARNING

- **Artificial Intelligence can be said to cover all the algorithmic techniques allowing software to simulate a complex reflection, with a view to offering a user assistance that is at least as efficient as that of a human.**

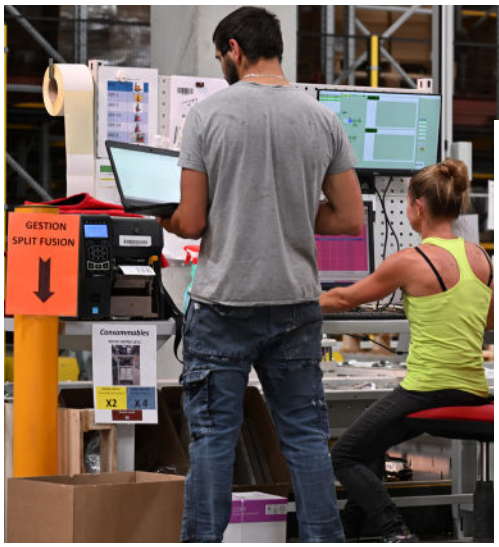
- **We are no strangers to this technology: we regularly experiment with it through applications equipped with user assistance modules integrating AI algorithms. Spam email detection, facial recognition for unlocking smartphones, or automatic photo categorization, along with automatic content proposal by video or music applications are just some of the examples that we encounter on a daily basis.**



- The designers of these applications are Data Scientists; True data and statistics experts, their goal is to collect and analyze information to transform it into real decision-making support tools. Depending on the type of issue to address, the Data Scientist, architect of AI solutions, will focus on models of one type or another. Thus, machine learning will be the preferred tool for forecasting issues or more generally for learning based on structured data, operational research for optimization issues, reinforcement learning for autonomous learning of behaviors and deep learning for language, text, image, video and audio processing issues. Even though all of these technologies will have substantial impacts on the general improvement of processes in the Supply Chain, it is more interesting to focus on machine learning and deep learning issues, which represent most situations currently studied in the industry.

MACHINE LEARNING :

HOW WOULD THE SUPPLY CHAIN BENEFIT FROM INTEGRATING IT?

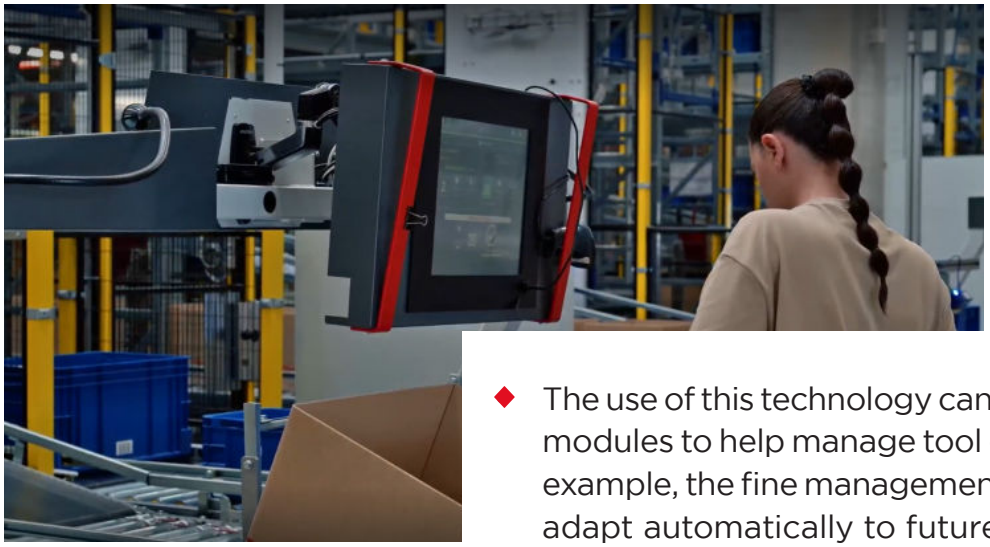


- **The Supply Chain has everything to gain from working with machine learning.**

- Indeed, there are many decisions that are taken in reaction to and following thresholds being exceeded. One of the roles of machine learning is precisely to predict these thresholds being exceeded. The goal therefore is to make these decisions by anticipating these events rather than reacting to them, which is very useful in the supply chain.

- Regarding the WMS, beyond its role of supervising the warehouse and its responsibility to report on the state of stock and order preparation, it is above all software for managing warehouse operations. As such, it makes, or helps the user to make process engagement decisions (launching replenishment rounds, preparation rounds, choice of location, etc.). In the vast majority of these situations, decision-making driven by the WMS – just like in a WCS, is triggered by exceeding a threshold set in advance by the business expert such as a warehouse user or software integrator.

The challenge of optimizing and correcting these operations is based entirely on the correct setting of these thresholds by the business expert, who must report as faithfully as possible on the right procedures to be implemented in order to act intelligently. Nevertheless, the operations are all essentially carried out reactively. Thus, an initial level of AI application in this context is essentially to be able to identify the most appropriate thresholds, but also to predictively anticipate the overrun of future thresholds. it will be necessary to call on an additional resource to absorb the workload. All these values configured in WMS and WCS, and which are usually the prerogative of business experts, can now be learned in a granular manner by AI modules in order to provide these experts with decision assistance tools that support their knowledge.



- The use of this technology can make it possible to offer users modules to help manage tool configuration. We can cite, for example, the fine management of rotation classes which can adapt automatically to future situations rather than being handled manually. Or even to set the minimum quantity thresholds for a product reference in the preparation station, before launching a replenishment wave, or to better estimate the quantity of order lines to prepare, from which it will be necessary to call on an additional resource to absorb the workload.

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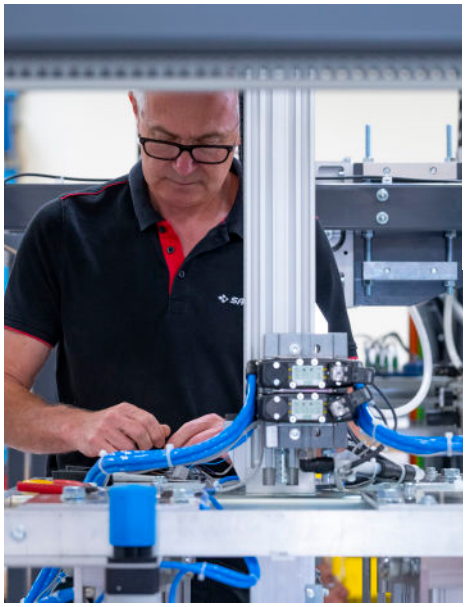
FORECAST



The main challenge for good control of warehouse operations by business experts who operate WMS and WCS is to set these threshold values such that the operations they entail allow the targeted flow to be achieved in a proactive manner. In this context, the management of intra-logistic operations represents a balancing act in which the warehouse manager juggles between the fragmented information available to him:

- What are the known order lines to prepare?
- What are the resources required to respond?
- What is the stock status?
- What are the truck appointments to observe?

... and the unknown information that arrives progressively:

- The continuous or batch flow of new orders to prepare
- The actual operation execution time
- Unplanned issues and contingencies

Thus, better identifying and anticipating all the events that punctuate the launch of operations makes it possible to avoid risk situations, but above all, coupled with policies to optimize operations (until now limited due to available information), to better understand all the processes. As an example, we can list the possibility of not incurring order shortages, or the launch of waves of urgent orders and of smoothing the load to support better flow.

Converting a smart configuration whose objective is to contain the undesirable effects of dynamics to better manage them: this is one of the main benefits that AI can bring to the Supply Chain and its optimization.

- **As an example, we can mention the issue of Labor Management in which warehouse managers seek to know in advance the number of operators required to pass the coming flow in order to plan the necessary staffing on a daily basis**

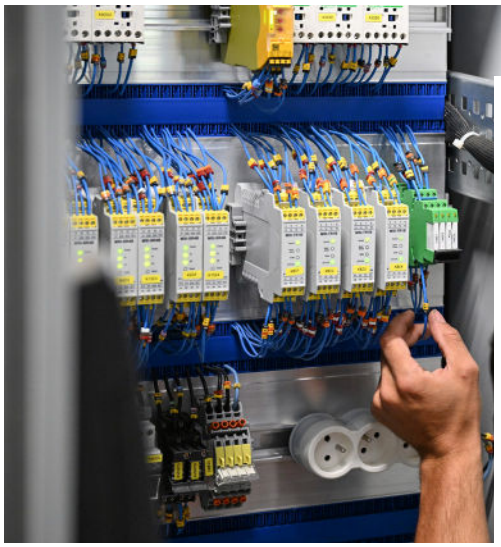
In the current context, WMSs try to cover the load transmitted to them by the ERP as soon as this latter knows all the orders to prepare. WMS configuration is responsible for translating this order volume into a number of necessary resources and the expected number of operators is deduced therefrom. A Labor Management module feed by Machine Learning algorithms, capitalizes on past experiences to better estimate the number of operators required. This freeing the user from having specific knowledge of the orders in the ERP, and additionally correlates as a parameters in the WMS of the number of people necessary. Thus, the forecast allows finer and more upstream predictions, leaving free rein for optimization algorithms to smooth out the coming day according to the need for resources.

PREDICTIVE MAINTENANCE

The challenge of equipment maintenance in warehouses is major and AI has an important role to play in this situation as it serves to maximize the rate of equipment use.

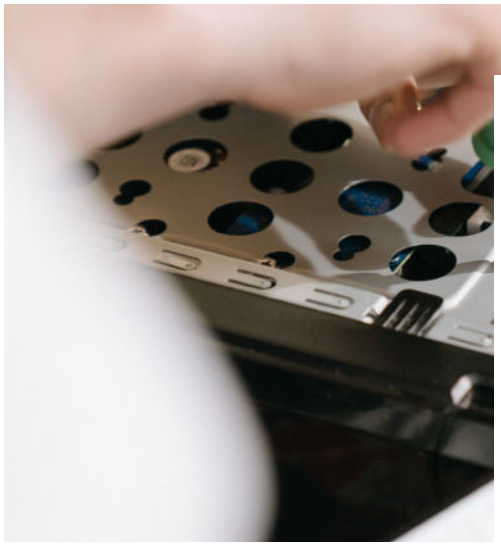
First of all, it is necessary to identify and categorize the different types of maintenance that exist.

«CONVENTIONAL» MAINTENANCE



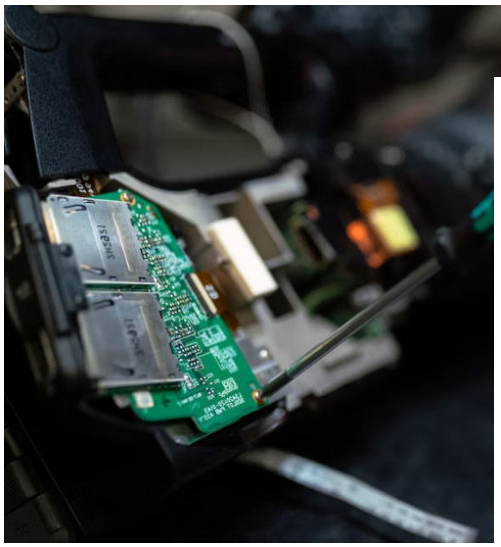
- **So-called “conventional” maintenance consists in waiting for the failure to occur before initiating a repair action.**
- **+ :** The advantage of this policy is the certainty of not activating an operator without reason. This latter must, however, have the equipment necessary for the repair at their disposal in order to make the trip as profitable as possible.
- **– :** There are many disadvantages to this policy, first of all the temporary loss of machine usability.

«PREVENTIVE» MAINTENANCE



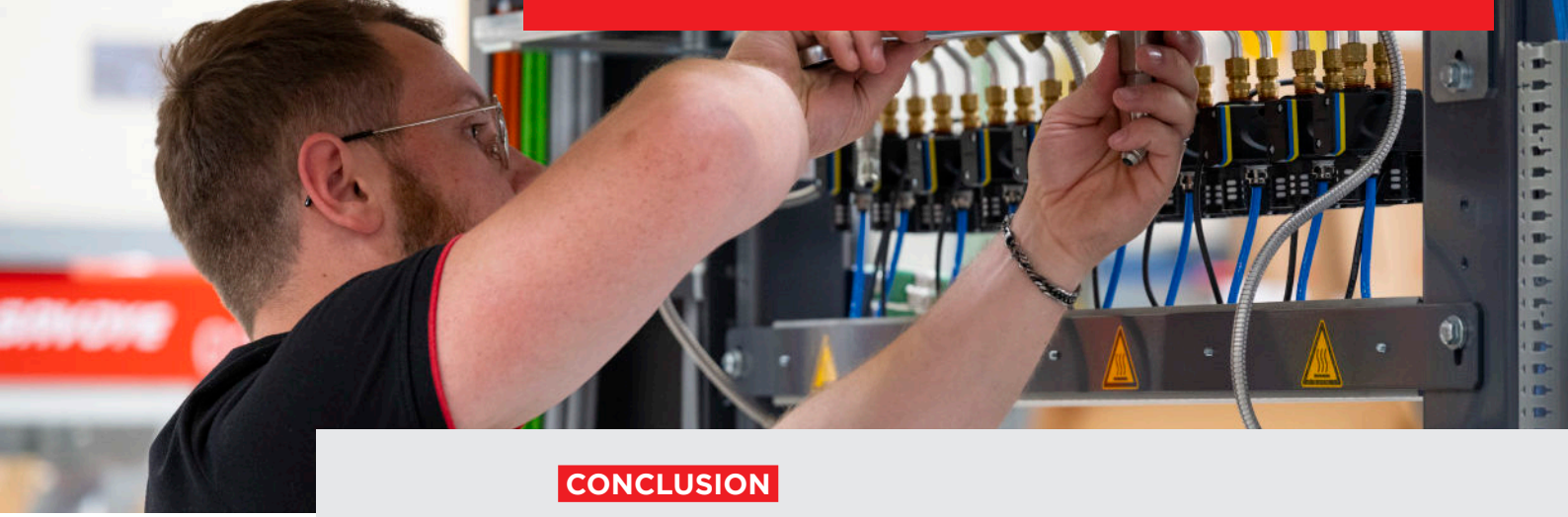
- **This is a more advanced maintenance policy. The aim is to maximize the rate of machine availability, while setting up a regular maintenance plan to monitor the progress of failure risks. Work carried out before the failure serve to limit their occurrence. These checks can be carried out periodically or conditionally.**
- **+ :** These maintenance plans have the merit of reducing the failure rate and therefore increasing the availability rate of machines.
- **– :** The main disadvantage is that it regularly solicits operators for actions that are not always relevant or even useless in avoiding risk.

«PREDICTIVE» MAINTENANCE



- **Predictive maintenance is the most advanced maintenance policy. Taking advantage of AI technologies to anticipate the risk of failures, they only recommend operator intervention when necessary. It also aims to maintain appropriate spare parts stock levels in order to be prepared for potential failures without causing overstock at the after-sales service. To achieve this, various sensors are fitted on the machines to collect the data available to predict failures (vibration sensors, heat sensors, audio sensors, etc.). The goal is then to define, by classification, failure risk profiles and to anticipate future failures.**

- This is the most efficient and relevant type of maintenance for warehouses wishing to maximize the use of their equipment.



CONCLUSION

AI offers forecasting modules, automatic image, video and audio identification and optimization modules to experts. This set of techniques will provide great assistance to end users, especially for low value-added tasks. Thus freed from these constraints, their know-how can be redirected towards more specific management activities.

Through all of these presentations, we can infer the capital impact that artificial intelligence will have on the tools of the Supply Chain. In the short term, next generation methods incorporating Machine Learning will allow finer and better anticipated process management than ever before.

In the short term, next-generation methods incorporating Machine Learning will allow finer and better anticipated process management than ever before. Where current methods seek to absorb risks in the management of operations by juggling between different software parameters, prediction methods will make it possible to better anticipate hazards rather than suffer them and to draw conclusions allowing smoothing of future activities. It remains up to the Supply Chain to fully take charge of this technological breakthrough so as not to be left behind in the very real advances opened up by artificial intelligence.

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