# THE ROLE OF ARTIFICIAL INTELLIGENCE IN MANAGING CUSTOMS RISK FOR ALGERIAN CUSTOMS

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**SUMMARY**

Nowadays, the trend toward adopting artificial intelligence (AI) in customs risk management has increased across the globe, yet it may not be efficiently perform the required if the design risk management process is not rich in many features and inputs that are accurate and mathematically applicable. In this paper, we have designed a recommendation system for customs risk management at the level of Algeria's customs whose current risk management system is still based on the discretion of customs agents, supported by certain internal laws and regulations that guide the decisions of Algerian customs agents. In the design of this recommendation system, we relied on the supervised machine learning where we used five different algorithms. These algorithms have resulted in close accuracy ranging from 97% to 99%. This model reduces the time taken to process different shipments and

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supports the decision-making process for customs inspectors. However, the current approach of risk management at the Algerian customs level requires greater depth, quality and accuracy at the input level in order to build a highly efficient customs risk management model.

**Key words:** Artificial Intelligence, Algerian Customs, Customs Risk Management.

**Jel Classification :** C55, C67, O33.

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## دور الذكاء الاصطناعي في إدارة مخاطر الجمركية للجمارك الجزائرية

### ملخص

في الوقت الحاضر، ازداد الاتجاه نحو اعتماد الذكاء الاصطناعي (AI) في إدارة المخاطر الجمركية في جميع أنحاء العالم، ومع ذلك قد لا يؤدي المطلوب منه بكفاءة إذا لم تكن عملية إدارة مخاطر في تصميمها غنية بالعديد من الميزات والمدخلات الدقيقة والقابلة للتطبيق رياضياً، في هذه الورقة قمنا بتصميم نظام توصية لإدارة المخاطر الجمركية على مستوى الجمارك الجزائرية، والتي لا يزال نظامها الحالي لإدارة المخاطر قائماً على السلطة التقديرية لاطارات الجمارك المدعومة ببعض القوانين واللوائح الداخلية التي توجه قرارات الجمارك الجزائرية، اعتمدنا في تصميم نظام التوصيات هذا على تعلم الآلة الخاضع للإشراف، حيث استخدمنا خمس خوارزميات مختلفة، أظهرت هذه الخوارزميات دقة عالية تتراوح من 97٪ إلى 99٪، يقلل هذا النموذج من الوقت المستغرق لمعالجة الشحنات المختلفة ويدعم عملية اتخاذ القرار لمفتشي الجمارك، ومع ذلك فإن النهج الحالي لإدارة المخاطر على مستوى الجمارك الجزائرية يتطلب مزيداً من

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العمق والجودة والدقة على مستوى المدخلات من أجل بناء نموذج عالي الكفاءة لإدارة المخاطر الجمركية.**كلمات المفتاحية** : الذكاء الاصطناعي، الجمارك الجزائرية، إدارة المخاطر الجمركية.

# LE ROLE DE L'INTELLIGENCE ARTIFICIELLE DANS LA GESTION DES RISQUES DOUANIERS POUR LES DOUANES ALGERIENNES

**RÉSUMÉ**

De nos jours, la tendance à l'adoption de l'intelligence artificielle (IA) dans la gestion des risques douaniers s'est accrue dans le monde entier, mais il se peut qu'elle ne soit pas efficace si le processus de gestion des risques de conception n'est pas riche en nombreuses fonctionnalités et entrées précises et mathématiquement applicables. Dans cet article, nous avons conçu un système de recommandation pour la gestion des risques douaniers au niveau des douanes algériennes, dont le système actuel de gestion des risques est encore basé sur la discrétion des agents des douanes, soutenu par certaines lois et réglementations internes qui guident les décisions des douanes algériennes. Dans la conception de ce système de recommandation, nous nous sommes appuyés sur l'apprentissage automatique supervisé où nous avons utilisé cinq algorithmes différents. Ces algorithmes ont abouti à une précision proche allant de 97% à 99%. Ce modèle réduit le temps nécessaire pour traiter les différentes expéditions et soutient le processus décisionnel des inspecteurs des douanes. Cependant, l'approche actuelle de la gestion des risques au niveau des douanes algériennes nécessite une plus grande profondeur, qualité et précision au niveau des entrées afin de construire un modèle de gestion des risques douaniers hautement efficace.

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## 1- INTRODUCTION

Time and cost are very significant factors in the field of international trade, with Minor and Hummels (2013) and Deardorff (2002) stressing that the longer certain goods are in transit, the higher the costs for economic operators and the lower the chances of future dealings for the country responsible for the delay. We can therefore say that customs play a key role in facilitating or impeding foreign trade. Hence, the need to increase the effectiveness and efficiency of the customs sector is evident in the current context of international trade, which is characterized by low traditional trade barriers, such as tariffs, and the expansion and growth of international trade (Grainger, 2008).

In this situation, developing countries' customs find themselves facing the challenge of balancing the need to facilitate trade with the need to comply with laws (Widdowson, 2004). requiring abandoning the traditional approach of customs work such as the gatekeeper, where both inward and outgoing merchandise was controlled and inspected (Biljan & Trajkov, 2012), and moving to a better approach that allows customs functions to be performed more effectively without harming trade facilitation requirements.

This time and cost importance has been translated into countries' rapid construction and development of customs risk management

systems with a view to improving customs performance, accelerating the customs process, and increasing its effectiveness(Davaa & Namsrai, 2015).

This will inevitably be based on technology-supported and partially or wholly automated systems, where many experiences confirm that automation of customs risk management systems improves their efficiency and enhances their effectiveness in maximizing revenue without damaging trade facilitation (Grigoriou, 2019).

As the role of AI in various areas has grown in our current time, so has the reliance on it by various customs agencies around the world to manage customs risks. AI can effectively reduce merchandise inspections without increasing risk levels (Hoffman et al., 2019) and enhance the value of customs data to ensure better analysis and understanding (Kavoya, 2020). AI also enhances customs' ability to separate different risk levels and improves the accuracy of targeting hazardous merchandise (Regmi & Timalsina, 2018). All this is in the context of matching the growth of international trade to allow various customs organizations to perform control functions effectively and fully without damaging trade facilitation.

However, insufficient attempts have been made to discuss the application of AI concerning customs risk management in developing countries, where customs risk management inputs in these countries differ from those in advanced economies owing to different physical

and human resources available to customs as well as different government objectives in these countries. These inputs follow the possibilities and orientations of customs organizations. Although there is consensus from most customs organizations around the world to use certain specific inputs in customs risk management (country of origin, irregularities, etc.), there are significant differences in the depth of these inputs and their ability to predict customs risks efficiently without compromising trade facilitation requirements.

Despite the huge potentials provided by AI in customs risk management and the huge efforts of the World Customs Organization and the World Trade Organization to develop the customs risk management systems in the developing countries through the convention that facilitates the trade and provides in Article 07 for the importance of this system (WTO, 2014), and the revised Kyoto Convention that encourages the use of the risk management techniques to target the high risk loads using modern technology(WCO, 2008), and SAFE standards that incite the customs agencies to adopt the emerging technologies in customs risk management, the customs in the developing countries are still very slow in coping with the common international practices in the customs risk management that rely on AI. In this regard, the trade facilitation database of the World Trade Organization shows that there are 62 calls for technical support by developing countries that seek updating their customs risk

management.(TFA Data Base, 2023) These calls are part of category C that includes the long-term commitments (the date of executing these commitments is 2036 in some states).

(Geourjon et al., 2012) states that this difference is due to the differences in the priorities of the developed and developing states' customs. In this context, facilitating trade is not a priority in the developing states compared to the security and compliance. These states see that the physical search and interventions guarantee the taxes that make an important share of their economies; in addition to the known restrictions on technology, funding, and human resources.

In this study, we seek to clarify the contribution of AI to improving the risk management process at the Algerian customs level so that it reduces intrusive inspection without prejudice to the requirements of control and laws. This can be done by building a recommendation system based on supervised machine learning starting from the inputs and characteristics of Algeria's customs approach. The results or outputs of this model are expected to allow us to assess past inputs and the extent to which they can achieve what is required (minimizing intrusive inspection while maintaining the level of control and compliance with laws) and thus judging the contribution of AI to improving the risk management process for Algerian customs as a whole.

This paper mainly focuses on the study of (Hoffman et al., 2019) that provides a detailed methodology to determine and choose a diverse set of data and inputs that help achieve an efficient customs risks management based on Machine Learning in South Africa. We relied on some of its outputs in building an AI model (Machine Learning) that supports the current customs risk management in Algeria. This method allows discovering the weaknesses of the Algerian customs risk management system that hinder the model's efficient performance. We must point that the inputs used in this model are not deep and diverse as in the case of (Hoffman et al., 2019) that includes many inputs that were studied and competed to reach the optimal model that allows for the achievement of high efficient customs risk management. Nevertheless, our inputs provide a starting point for the adoption of AI in the customs risk management in Algeria.

Therefore, we will tackle specific research questions in this study.

- Is it possible to adopt artificial intelligence (AI) in customs risk management of Algerian customs?
- Does AI work efficiently under the current approach to risk management at the Algerian customs level?

Assuming that the answer to the last question is no, i.e. AI will not work efficiently under the current Algerian customs approach, this leads us to another research question:

- What needs to be improved so that AI can work efficiently in managing customs risks in Algerian customs?

T should be noted that efficiency in the context of customs risk management is intended to achieve greater accuracy in identifying risks and violations in goods and cargo, thereby reducing unnecessary intrusive inspection and facilitating legitimate trade.

## 2- BACKGROUND

In this part, we will superficially address the most important concepts and fundamentals of risk management in organizations in general and customs risk management in particular.

### 2.1- Risk analysis:

Over the ages, Man has faced dangers in various aspects of life. By dealing with these dangers through the experimental system of his unconscious perception, man has been able to survive. This primitive system is based on linking experiences with emotions and classifying them, which is termed "survival instinct", but it was not possible for Man to reach his current evolving image without developing an analytical system that supports his "survival instinct" (Slovic, 2010). The analytical system paved the way for risk analysis as an independent science that improves decision-making based on identifying, describing, and analyzing risks so that we can address them at a later stage. Risk analysis encompasses almost every aspect of

life, including economic, political, security, environmental, medical, and other spheres (SRA, 2022).

In this context, risk analysis is a systematic process that aims to understand, express, and characterize the nature of risks with available knowledge, whether risks of interest to individuals, public or private sector organizations, or to society at the local, regional, national, or global level.

**2.2- Risk management:**

More narrowly, risk management is part of the science of risk analysis and includes designing appropriate measures to deal with different risks such as prevention, mitigation, adaptation, or participation, as it is a systematic application of management procedures and practices that provide customs with the information needed to address movements or cargoes that indicate risk (WCO, 2008). Risk management often involves a differentiation between the costs and benefits of reducing risk and choosing a level of risk that can be borne (Priest, 2012).

The risk management process is mainly aimed at developing appropriate tools to deal with problems of complexity, uncertainty, and ambiguity based on the characteristics of different types of risk. (Renn & Klinke, 2002)

**2.3- Risk management strategies:**

According to (Gjerdrum & Peter, 2011), (Bunting, 2008) and (SRA, 2022), risk management involves three common strategies. **The warning strategy** aims to avoid risks by properly assessing risks if the risk's likelihood and consequences are known and clear. **The discursive strategy** is appropriate if uncertainty is the predominant feature, i.e. if risks and consequences, in this case, are unknown. It is an effective strategy for planning and resolving crises and conflicts. Finally **the deliberative strategy** is often required in all three types of management.

These three strategies seek to provide greater flexibility in responding to risk management systems, focusing on developing alternatives, improving the environment, and developing and strengthening the immunity of risk management systems. In some cases, it may be required to combine more than one strategy in order to achieve the desired goals.

**2.4. Risk management process structure:** (SRA, 2022)

This structure  explains that the regulation of policy development and operation often takes place through the following phases that are consistent with the decision theory of (ALTAUS et al., 2020):
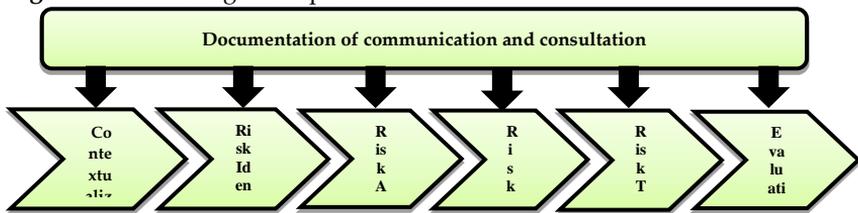
1. Contextualization.

2. Risks identification.

3. Risk Analysis.

4. Risk assessment and decision-making.

5. Implementation and Risk treatment.

6. Evaluation and audit (policy effectiveness assessment).

At all stages of the risk management process, documenting communication and consultation between all units and stakeholders is essential because the risk management process is inclusive and not limited to a particular unit.

**Figure 1.** Risk management process structure



Source: Author

**2.5- Risk management in customs:**

Like other organizations, risk management is a vital and significant part of customs work. The risk to customs on the revenue side lies in the risk of undervaluing goods and determining the origin and classification of goods. In addition to the side of barriers and restrictions, Customs face the dangers of trafficking in drugs, arms, and restricted substances, as well as the risks of infringement of intellectual property rights and other health risks (WCO, 2008). In order to manage these risks, most customs organizations adopt the globally recognized channel system, which often consists of three channels of different colors (green, red, yellow). Each color represents a different hazard level and therefore each channel involves specific procedures

appropriate to the risk level of goods destined for it. In some cases, another channel of another color (often blue) is added, as in the Macedonian experiment (Biljan & Trajkov, 2012). This is in order to keep pace with the customs work methodology of the relevant customs organization, i.e. the channel system is a dynamic system designed and adapted to the needs and capabilities of customs organizations.

**2.6- Description of Algerian risk management process:**

Algerian Customs  rely  on a simple and selective risk management system to a certain extent, largely based on human intervention, which makes the results of classifying the risk levels of merchandise subject to the discretion of Customs agents supported by various customs laws and legislation. This type of system poses multiple ethical risks (Geourjon et al., 2012), as well as this type does not support the trade facilitation requirements called by the amended Kyoto Convention (WCO, 2012), as it directs the majority of merchandise toward auditing and inspection regardless of their different risk levels. Artificial intelligence is therefore an appropriate recommendation to overcome these problems facing Algeria's customs risk management process.

### 3- ALGERIA'S ICT INFRASTRUCTURE:

It is necessary to understand that customs risk management is the final stage where data reaches the processing stage and decision-making stage, as it is preceded by many processes before it reaches its current form. These processes, aimed at collecting customs data,

depend heavily on technological infrastructure. In this section, therefore, half of the various characteristics of ICT infrastructure directly affect the work of Algerian customs, namely customs risk management.

**3.1- Description of Algerian customs information system:**

SIGAD is a customs information system currently based on the open-source operating system Linux/gnu from the distribution of red hat enterprise 6.2 known as SANTIAGO. The SIGAD system is the only customs information system developed and used in Algeria from 1995 to the present day. It has known limited updates at certain stages to take its current form. The first version of this system was limited to the automated and electronic processing of customs clearances (Macatee, 2022).

In a second phase, as part of the modernization of Algeria's customs system, the functions of the SIGAD system were expanded to provide electronic access to customs economic systems and automated processing of customs disputes. It was the first time that several customs functions were digitized simultaneously, resulting in the SIGAD 2 system, which was first applied in 2004 at the port level of Algeria and was then extended to customs offices across the country. The Customs Information System consists of several subsystems, each of which deals with a particular aspect of Customs functions, wholly constituting an information system to frame and control the operations

of foreign trade, so that it continues to work in this form to this day. (Algerian Customs, 2022)

**Table (01):** Components of the SIGAD system

| Sub-systems | Functions |
|---|---|
| Embedded system | - Classification and coding of goods. |
| Customs Operations | - Registration of all customs procedures from the entry of goods until their exit from the warehouses. |
| Tax collection | - Payment receipt for customs fees.<br>- Accounting Books. |
| Dispute settlement | - Registration and follow-up of irregularities related to trade operations. |
| Customs Statistics | - Registration and processing of various statistics of foreign trade. |

Source: Author

**3.2- Data warehouse:**

A number of Algerian Customs frames, namely the Director-General of Customs, Mr. Farouk Behmid, and the Director of the Signature Centre, Mr. Ismail Boudadi, have stated that Algeria has initiated the completion of the Algerian Customs Data Centre, which was assigned to China's Huawei for Digital Solutions. The project was expected to be delivered during the first six years of 2019, but the project is witnessing a disruption and has not yet been delivered for unknown reasons. (ALGERIAN NEWS AGENCY, 2018)

**3.3. Various bodies relevant to Algeria's customs work:**

The following table shows the various local and international organizations relevant to Algerian customs.

**Table (02):** Various bodies relevant to Algeria's customs work

| Locally | Internationally |
|---|---|
| Ministry of Commerce | Statistical Branch of the United Nations |
| Ministry of Finance | International Financial Organisations |
| Ministry of Agriculture | Statistics Bureau of the European Union |
| Ministry of Fisheries | |
| Ministry of Small and Medium Enterprises | |
| Chamber of Commerce | |
| Chamber of Agriculture | |
| Bank of Algeria | |
| Commercial Banks | |
| National Gendarmerie | |
| National Security | |

Source: Prepared by researchers based on: (Directorate General of Customs, 2021)

As part of strengthening cooperation between customs and banks, a protocol of understanding was signed between the General Directorate of Customs and the Professional Association of Banks and Banking Institutions on the exchange of information related to foreign trade operations on  March 23 ,  2014. All of this is based on a separate, limited-function interface dedicated solely to checking the status of

customs clearance by banks. One of the reasons that contributed to this cooperation is that the transfer of funds before the implementation of the Protocol was without any proof of goods access into Algeria despite the completion of its customs clearance process. The latter is due to delays in sending customs documents to the Bank or sending them to another Bank by mistake. Except for banks, there is no other platform linking customs with previous customs-related bodies listed in Table (06). (National Association of Banks, 2022)

### 4- METHODOLOGY:

**4.1. Data description:**

Due to the severity of Algerian Customs and its unequivocal refusal to share customs transactions data with any other party regardless of the reasons, the Customs officials of the Regional Customs Directorate of Annaba (a city in the eastern part of Algeria) have proposed to us a field visit to view the Customs operation on the ground and specifically the customs' risk management process. This visit was very useful, allowing us to take a clear image of the process of risk management at the Algerian customs level and learn the data needed to build and replicate the model.

The model relies mainly on the Harmonized System of 2017 because it is used now by the Algerian customs to classify goods. It is supported by 05 diverse inputs that represent the customs data available in the customs statements and archives (for the previous violations). They are

easily collected and classified information. In addition, all the inputs were coded using the digits 0-1 because the available data are not so deep to allow designing a more diverse and complicated model.

**Table (03):** Model input and coding

| 1 | 0 | Inputs |
|---|---|---|
| Unreliable country | Reliable country | Country of origin |
| Importation | Exportation | Type of operation |
| Goods with special administrative procedures | Ordinary goods | Nature of goods |
| History of past irregularities | No history of past irregularities | Past irregularities |
| Not the first operation of the economic operator | First operation of the economic operator | Past operations |

**Source: Author**

**CLARIFICATION**
**Country of origin:**

The country of origin is classified according to Algerian Customs as a reliable country in the event of cooperation agreements between the two countries, whether trade or regulatory agreements between the

Customs or economic interests of the two countries. In the absence of such cooperation, the country of origin shall be classified as an unreliable country.

**Nature of goods:**

According to Algerian Customs regulation, there is a list of 13 types of goods. The treatment of which requires passing through a set of special administrative procedures. These procedures are the issuance of specific clearances, certificates, or permits.

Based on the 2017 harmonized system, the goods were distributed to the five inputs through Microsoft Excel 2013 as follows:

**Table (04):** Method of distributing goods on the model inputs

| Nature of selection | Inputs |
|---|---|
| Random | Country of origin |
| Random | Type of operation |
| By reference to the list of goods with special administrative procedures | Nature of goods |
| Random | Past irregularities |
| Random | Previous operations |

Source: Author

Three channels of different colors have been selected to process goods so that each channel represents a certain level of risk and therefore each channel has different procedures as follows:

**Table (05):** Classification of goods by risk degree

| Channel | Level of risk | Procedure |
|---------|---------------|-----------|
| Green | Low | Heading to pay fees and clear goods directly |
| Orange | Average | Accurate control of the operation documents |
| Red | High | Goods inspection and document control |

Source: Author

207 goods were classified by the author according to the three channels based on the criteria observed in the field visit, which we explain as follows:

**Table (06):** Criteria of each channel in the classification of goods

| Channel | Classification criteria | |
| --- | --- | --- |
| | **INPUTS** | **CODE** |
| **Red channel** | Country of origin | 0 or 1 |
| | Type of operation | 0 or 1 |
| | Type of goods | 1 |
| | Irregularities | 1 |
| | Previous operations | 0 |
| **Orange channel** | Country of origin | 1 |
| | Type of operation | 0 or 1 |
| | Type of goods | 0 |
| | Irregularities | 0 |
| | Previous operations | 1 |
| **Green channel** | Country of origin | 0 |
| | Type of operation | 0 or 1 |
| | Type of goods | 0 |
| | Irregularities | 0 |
| | Previous operations | 1 |

Source: Author

The previous table shows that each channel has certain criteria for each input. On the basis of these criteria, the goods are directed to them. Inputs that accept both types of coding 0 or 1 are considered insignificant in the channel's selection criteria.
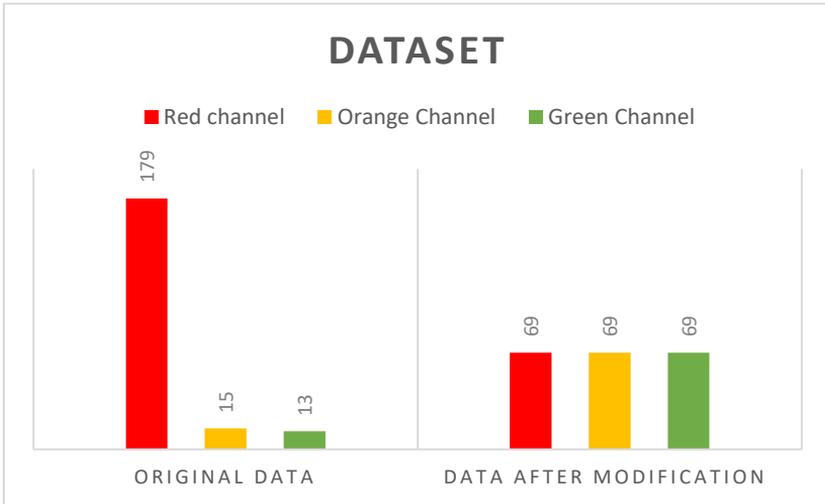
We classified 207 different goods according to the previous criteria in Table (04). After scanning the samples, we found them as follows:

➢ The green channel: 13

➢ The orange channel: 15

➢ The red channel: 179

Clearly, this data classification does not help us train the model because 86% of the goods are directed toward the red channel. In order to train the model to operate efficiently, we need more goods directed toward the green and orange channels, so we have added many goods under the name Unknown merchandise directed toward the green and orange channels (carrying the same input coding of the orange and green channels) while excluding excess samples so that the training data is evenly distributed across the three channels:

➢ The green channel: 69 merchandise

➢ The orange channel: 69 merchandise

➢ The red channel:69 merchandise

**Figure 2:** Dataset



Source**:** Author

**4.2- Instruments**

In this study, we seek to design a recommendation system based on machine learning to classify customs risk into three channels according to the levels of risk mentioned earlier in Table 04, so we rely on the following means and tools:

- Laptop Toshiba, i5, sixth generation, Ram 8, Windows 10.

- programming language: Python

- Excel 2013

- Anaconda environment

- Jupyter notebook

- Visual studio code for editing code

**4.3- Algorithm training and testing:**

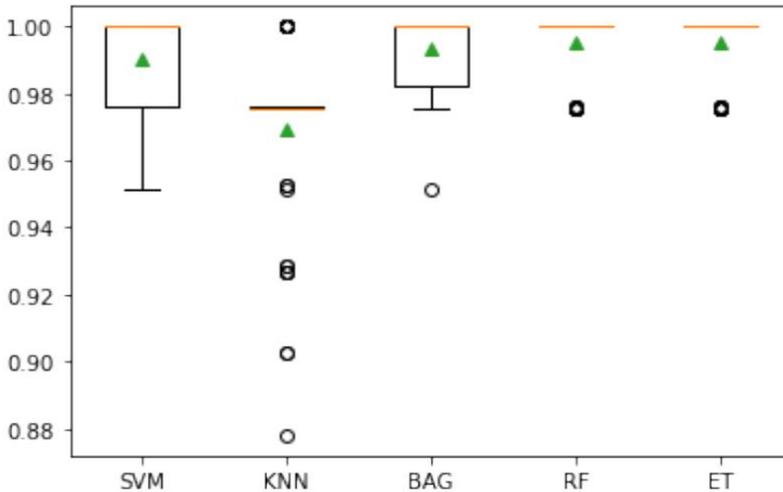We chose to rely on 5 known algorithms of machine learning as follows:

- SUPPORT VECTOR MACHINE (SVM)

- K-NEAREST NEIGHBOURS (KNN)

- Bagged Decision Trees (BAG)

- Random Forest (RF)

- Extra Trees (ET)

We trained the classifiers using the default parameters of the algorithms. The training and testing are done using a five-fold cross validator for a total 10 times, then we computed the mean accuracy of the total of 50 built classifiers.

## 5- RESULTS:

Figure (03) shows the accuracy of each of the five algorithms we have relied on to design the model using Python programming language.

**Figure 3.** The results of algorithms accuracy selected for the model



Source: Author (based on Python)

**6- RESULTS DISCUSSION:**

**6.1- Model design:**

All algorithms yielded great models accuracy ranging from 97 to 99%, but given the box and whisker plot, SVM and RF tend to be more stable where the spread of the testing accuracy is tight, and median and mean accuracy are very close.

In terms of model composition and input selection, the refusal of the Algerian customs to share customs risk management data forced us to simulate its risk management approach through building similar data that performs the same purpose.

It is clear that the model designed to reflect risk management at the Algerian customs level is simple and lacks more features and inputs compared to more sophisticated risk management systems that are more complex and accurate for their output. More features means a more complex and efficient risk management system. The simplicity of the input and features interprets the orientation of 86% of goods toward the red channel before processing and modifying data, which corresponds to the gatekeeper's approach that hinders trade facilitation efforts.

**6.2- Analysis and description of ICT infrastructure in Algeria:**

- There is no electronic data interchange infrastructure between Algerian Customs and various services and entities related to Customs work, as data transmission from one organization to another is still performed in paper form.

- Although the current information system, SIGAD, of the Algerian Customs is provided by Red Hat Enterprise Linux, distributed on more than 9 million servers worldwide and relied on by many organizations in many technology-based business operations, its current use by Algerian customs does not permit the efficient processing and compilation of information. This is because it is used as a separate subsystem based on the manual entry of paper data of economic operators into the system, which is time-

consuming and results in many errors, negatively affecting the efficiency of the risk management phase.
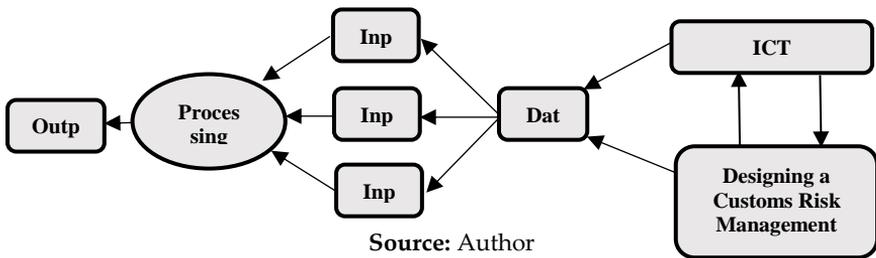
- The absence of a data warehouse that allows for the collection, processing, and analysis of customs data impedes the development of Customs risk management in Algeria, as it is a process characterized by the data and characteristics of each country. The development of risk management is a continuous process of learning from available data.

- The process of managing Customs risks is not limited to goods but also travelers. This aspect is completely neglected by Algerian Customs and does not fall within any information scheme, whether subsystems of the SIGAD system or an independent travelers' system.

### 6.3- Theoretical implications:

This paper is the first of its kind to discuss Customs risk management in Algerian customs. This study is expected to be a valuable addition to research aimed at helping and guiding customs organizations in developing countries to adopt smart systems to manage Customs risk. These smart systems highlight the difficulties and obstacles faced by these countries' Customs organizations in their path toward adopting AI as a future orientation in the same aspect of Customs functions (risk management). The results of this study emphasize the need to improve Customs risk management inputs to

reach effective targeting of high-risk cargo and shipments based on AI. However, there are two main reasons as obstacles to Algerian Customs' access to appropriate inputs of this type of smart system, which are the underdevelopment of its ICT infrastructure and the inappropriate design of the risk management approach. These two aspects prevent Customs from obtaining a rich and deep set of Customs data, as inputs are known to be built and formed from available data. Therefore, any lack of data will necessarily reflect the quality of inputs used in Customs risk management and thus affect the efficiency of the Customs risk management system as a whole. All of the above is shown in the next figure.

**Figure 04.** The importance of ICT infrastructure and the Designing of Customs RM approach in enriching data



**Source:** Author

**6.4- Managerial implications:**

The findings of this study may help the Algerian Customs decision makers and the developing states improve the inputs of the Customs risk management based on the investment in the

infrastructure of Big Data and Information Technology and strengthening the cooperation with the partners to allow the flow of diverse, deep, and exact data that can be used in designing smart systems for an efficient Customs risk management.

**6.5- Limits of the study and futur contributions:**

This research has several limitations:

First, this study focuses on the process of Customs risk management. Future research can examine these findings in other areas as risk management is a necessary process in almost all areas of life.

Second, the scope of application of this study is the Algerian Customs. Future researchers can apply this study to many Customs organizations in developing countries to ascertain the generalizability of the results, given that developing countries are often similar in many respects, in particular ICT infrastructure.

Third, this study considers the obstacles and difficulties that prevent the efficient application of AI in managing Customs risks. Inappropriate inputs are found to be highly responsible for this, so the study opens prospects for studying customs data in depth to reach the best input combinations that achieve efficient Customs risk management based on artificial intelligence.

## 7. CONCLUSION:

The study concluded that the adoption of AI in risk management in Algerian Customs is possible starting from a recommendation system

based on machine learning, which contributes to reducing dependence on the human component in the process of classifying goods according to risk levels. However, its contribution to trade facilitation in its current form is limited, as AI in this context represents the practical and applied aspect that programs and applies orders according to a pre-existing approach and plan. The current Algerian Customs approach is superficial in classifying Customs risks, so the outputs will continue to send the majority of goods toward intrusive inspection, as confirmed by the outputs of the model designed in our study. The current approach to risk management at the Algerian customs level was therefore incompatible with the trade facilitation standards advocated by the World Customs Organization and the World Trade Organization.

The application of AI in Customs risk management requires a smooth flow of information along the stages leading up to the Customs risk management phase. This requires the development and improvement of Algeria's current ICT infrastructure, which lacks an electronic data interchange strategy and ground to regulate the flow of information between different parties of Customs work. It also lacks an acceptable Internet flow that ensures the rapid flow of such information, as well as the absence of data warehouses although they are critical in the collection and organization of the various data necessary for Customs risk management.

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