Artificial intelligence for added value in the creation, implementation, and evaluation of national export strategies

Report prepared for the International Trade Centre (ITC)

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Executive summary

A National Export Strategy (NES) is an action plan that sets priorities, allocates resources, and specifies actions to strengthen an economy’s international trade capabilities, seeking to enhance its economic growth and development. In recent times there was an increase in the number of national initiative documents concerning strategic trade and development, with international organizations increasingly assisting countries with trade strategies. Many developing countries face challenges to ensure their trade dynamics effectively and efficiently contribute to their long-term sustainable development. In this context, technology can be a helpful tool in the NES process.

Based on a literature review, use cases, and expert interviews, this report highlights key ways in which artificial intelligence (AI) can add value to the creation, implementation, and evaluation of a NES. For the organization of the paper and given the wide range of possibilities through which the adoption of AI can affect international trade, the sub-sections of creation, implementation, and evaluation focus on key areas in which AI can be a valuable tool:

(a) Creation is focused on identifying international opportunities and determining priority sectors for the NES (supply-side capacities). It covers AI possibilities for diversification and expansion of exports, analysis of national strategies and sectors, assessment of trade trends, and analysis of trade agreements.

(b) Implementation mainly refers to the streamlining of processes and promotion of exports, thus covering aspects of the business environment and market entry.

(c) Evaluation reports on identifying atypical events and risks to the trade sector and measuring NES effects on economic and development outcomes.

There are also important considerations, challenges, and limitations related to the incorporation of AI technology in the NES process. Regarding the macro-level dimension, challenges include the ethical issues related to the use of AI and its potential to widen the gap between developing and developed countries. On a more technical aspect of the implementation of the technology, important areas to AI adoption that present multiple challenges are data availability and effective management, the adequate definition of systems and their interpretability, AI adoption costs and technological talent needs, and risk management and mitigation.

The report concludes by summarizing multiple ways in which AI can add value to the creation, implementation, and evaluation of NESs across dimensions, holding great potential to help countries enhance their economic growth and development through strengthening their international trade sector. High-level actions point that can be helpful in AI adoption are evaluating the methods that can aid in the NES process and incorporating those that are viable for the context and have a high likelihood of providing valuable input, generating a strategy to address their challenges and risks, and incorporate AI considerations to the NES, setting a foundation for future development of AI uses.
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I. Introduction

International trade is recognized as an engine for countries' economic growth and development, for it can play a critical role in promoting job creation, raising living standards, and growing national income (United Nations [UN], n.d.) A National Export Strategy (NES) is a vision and action plan that seeks to improve export performance and lead to sustainable development and economic growth. NESs increase the power of trade to build sustainable economic development by setting priorities, allocating resources, and specifying actions to boost competitiveness, create value, and develop new markets. The strategy provides a roadmap for stakeholders in the public, private, and civil society sectors to orient decisions, create regulations, and prioritize activities. Although there are general steps to create and carry out an export strategy, countries must tailor their plan to their specific characteristics and situations; there is no one-size-fits-all strategy (Njoroge, 2010).

According to classical international trade theory, countries tend to export the products and services in which they have a comparative advantage, and exports will foster economic growth through increased revenue and capital accumulation, the generation of economies of scale, and the promotion of employment, among other paths. However, many developing countries face challenges to manage their trade interactions and make sure that they effectively and efficiently contribute to their long-term sustainable development. This is largely due to them having limited capacity to analyze policy options, implement tailored national trade policy frameworks, and evaluate them effectively (United Nations Conference on Trade and Development [UNCTAD], n.d.). Also, countries can develop a short-term benefit approach to their plans, which can reduce the impact that trade can have on their long-term development.

Technology can assist in the process of creating, implementing, and evaluating a NES and shaping trade policy, supporting countries in tailoring principles to improve their export capacities. The creation of a NES generally implies the definition of an introduction, medium to long-term vision, objectives, cross-cutting issues, priority sectors, and a plan for financing and implementation (Njoroge, 2010). The implementation of the NES refers primarily to how the plan is put into practice. The evaluation of the NES is understood as the analysis of data that is associated with the NES activities to overview and assess progress and impact. Artificial Intelligence (AI) can streamline processes, expand horizons, and improve the accuracy and increase the quantity of the data used for and by the NES in these stages.

A preliminary analysis shows that there is not extensive literature regarding how AI can assist in the generation, implementation, and evaluation of NESs, providing the opportunity to build better trade policies. This report prepared for the International Trade Centre (ITC) seeks to gather relevant information, frame it, and analyze it to identify possible ways in which AI can assist in the creation, implementation, and evaluation of NESs. It identifies important considerations, challenges, and limitations regarding its adoption, and provides conclusions and high-level recommendations.
II. Background

NESs aim to set structures and systems in an economy to promote development and economic growth. They are blueprints that seek to diversify the economy, strengthen export industries, generate quality jobs and improve business environments, and increase earnings from foreign exchange (International Trade Centre [ITC], 2022). In 2008, the Commonwealth Secretariat carried out an evaluation of NESs, finding them worthwhile and suggesting they should be continued subject to the demand of interested countries (Record & Mtonya, 2008 as cited in Njoroge, 2010). According to an ITC report, in recent times there was a significant increase in the number of national initiative documents concerning strategic trade and development: they grew five-fold in the 2004-2015 period. Data indicates that international organizations increasingly assisted countries in the creation of these strategies (ITC, 2017). Since 2003, ITC has facilitated over 100 trade strategies in over 60 countries across 50 sectors (ITC, 2022).

As countries integrate into the global economy, emerging technologies provide a great opportunity to deepen our understanding of the dynamics of trade and generate better trade policies and strategies for economic growth and development. A report by PwC highlights that global GDP could rise by up to 14% in 2030 due to AI, which would make the adoption of AI the biggest commercial opportunity of the present (PwC, n.d.). Emerging technologies have already been generating deep-rooted changes in the trade sector across the world. For example, global value chains are using AI algorithms to improve predictions of changes in trends or situations, such as in consumer demand, improving their risk management strategies. AI is also being implemented to make e-commerce more efficient and make international trade more sustainable (International Telecommunication Union [ITU], n.d.a). Results from a 2020 global survey on businesses launched by the World Economic Forum (WEF) highlight that the three most transformative technologies for trade according to respondents were the inclusion of the internet of things in the supply chain, the adoption of electronic payments, and the development of e-commerce platforms (WEF, 2020). During the COVID-19 pandemic, the use of technology in international trade expanded. As an example, 65% of the 2020 WEF survey respondents reported incorporating new technologies which reconfigured value chains (WEF, 2020).

AI and other emerging technologies such as the Internet of Things, and blockchain can be key tools to overcome worldwide challenges not only in the international trade arena, but in other areas, and many times they are used jointly. These technologies are said to have brought the fourth industrial revolution (Schwab, 2016; Joshi, 2021); the WEF has established a Centre for the Fourth Industrial Revolution (Industry 4.0) to help shape policies and strategies in AI and other technologies (WEF, n.d.). The technologies can assist in accomplishing the Sustainable Development Goals (SDGs) (Vinuesa et al., 2020). For instance, AI systems can assist in achieving the eradication of poverty (Goal 1) by predicting pockets of poverty or can foster health (Goal 3) by making illness diagnoses more precise.
AI is a broad term, defined by the International Telecommunication Union (ITU) as comprising “...a set of widely different technologies, which can be broadly defined and grouped as 'self-learning, adaptive systems'.” (ITU, n.d.b) The OECD describes an AI system as “…a machine-based system that is capable of influencing the environment by producing an output (predictions, recommendations, or decisions) for a given set of objectives. It uses machine and/or human-based data and inputs to (i) perceive real and/or virtual environments; (ii) abstract these perceptions into models through analysis in an automated manner (e.g., with ML), or manually; and (iii) use model inference to formulate options for outcomes. AI systems are designed to operate with varying levels of autonomy” (Organization for Economic Co-operation and Development [OECD], n.d.). Subfields within AI are vast, including evolutionary computations, and visioning applications, among others.

Machine Learning (ML) is one of the most popular types of AI and can be defined as “a subset of AI in the field of computer science that often uses statistical techniques to give computers the ability to "learn" (i.e., progressively improve performance on a specific task) with data, without being explicitly programmed" (Ongsulee 2018 as cited in United Nations Industrial Development Organization [UNIDO], ITU & ITC, 2021, 26). Deep Learning (DL), a subset of ML, is an important method used to process information following a structure similar to that of the human brain. Artificial neural networks (ANNs) are a subfield within DL that uses mathematical probability; they are inspired by the activity of human neurons, connecting information between one another (UNIDO, ITU & ITC, 2021). Natural language processing (NLP) is another AI subfield that combines computational linguistics, referring to rule-based models of human language, and statistical, ML, and DL models to enable computers to comprehend text and voice (IBM, 2020).

ML methods can generally be classified as supervised, unsupervised, or reinforcement learning. In supervised learning, a model associates inputs and outputs based on data and feedback from individuals. In unsupervised learning, the function explores the data without having set output variables. In reinforcement learning, the algorithm learns to execute a task by trying to maximize the rewards it obtains from carrying out a task (McKinsey & Company [MKC], n.d.).

In the private sector, multiple companies have already adopted AI, and ML particularly, to their operations. The MCK Global 2017 Survey on the state of AI suggests that adoption of the technology was on a growing trend and that firms saw significant benefits from its implementation: use of AI in at least one purpose increased from 50% to 56% of all respondents, and the increase was particularly notorious at companies headquartered in emerging economies. The functions for which businesses were most adopting AI were service operations, product and service development, and marketing and sales. Respondents reporting at least 5% of earnings due to AI before interest and taxes grew from 22% to 27% in the 2021 survey (Chui et al., 2021).
Countries have been implementing AI strategies and integrating technology into national plans. Between 2017 and 2020, 32 countries and regions published AI strategies, and in 2021, 22 countries and regions were developing AI strategies (Zhang et al., 2021). According to the World Bank, the main barriers that governments experience to the adoption of AI are unawareness of its potential, inadequate foundational digital technologies, low availability or quality of data, and low access to digital skills (World Bank Group [WBG], n.d.).

International organizations are also conducting multiple efforts regarding AI adoption. The OECD has implemented the AI Policy Observatory to inform AI policy-related development. The UN has the AI for Good year-round digital platform where stakeholders connect and discuss AI solutions to advance the SDGs (AI for good, n.d). ITU publishes the annual report “United Nations Activities on AI” since 2018, detailing the activities run by multiple UN agencies and bodies. In 2021, the report featured more than 200 projects (ITU, 2021). In October 2020, the High-Level Committee on Programmes of the United Nations (HLCP) decided to create an inter-agency working group on AI (IAWG-AI) co-led by UNESCO and ITU (UN System Chief Executives Board for Coordination [CEB], n.d.).

Although AI provides opportunities and benefits, it also implies risks. AI adoption poses wide-ranging impacts on economies and gives rise to ethical concerns regarding multiple dimensions, such as data privacy, the relevance of AI to decision-making, and biases of systems, among many others. In this context, a significant challenge for governments is the design and implementation of AI regulations, frameworks, and policies to address the issues related to AI adoption and minimize risks.

Achieving equitable access to the opportunities of AI among and within countries is also a challenge. Developed economies could enhance and expand their comparative advantages through the incorporation of AI, and a lack of AI resources in developing nations could aggravate the technological divide that exists between nations (Meltzer, 2019). Mitigating policies and cooperation projects among stakeholders in the public, private, academic, and civil society can play an important role to reduce negative impacts on society and promote technological advancement in countries where AI advancement might be relatively more challenging.

The relationship between AI and international trade is vast and can be approached from a wide variety of angles. This section provides relevant information that highlights the high-level relationship between AI and international trade, a conceptualization of AI, and a high-level overview of the state of play regarding AI adoption and its challenges. The following sections focus on how AI can assist in the creation, implementation, and evaluation of a NES. Section III focuses on the opportunities for AI application in the development of a NES. Section IV emphasizes important considerations regarding AI adoption, going over challenges and limitations. Finally, Section V provides conclusions and high-level recommendations on how AI can add value to the creation, implementation, and evaluation of NESs.
III. Opportunities for AI application in the development of a NES

Based on a literature review, analysis of use cases, and expert interviews (the list of interviewees is in the appendix), the following section details ways in which AI can assist in the (a) creation, (b) implementation, and (c) evaluation of NESs. As stated in the introduction, the creation of a NES refers to the definition of a medium to long-term vision, objectives, and priority sectors (Njoroge, 2010). The implementation of the NES implies how the plan is put into practice. The evaluation concerns the assessment of the progress and impact of the NES.

According to ITC, for a NES to achieve the changes sought per its objectives, it must address four components: supply-side capacities that allow matching national productivity with opportunities in international markets; the business environment to reduce trade barriers, upgrade institutional services in support of exporters and lower costs; market-entry to promote the internationalization of businesses; and ensure trade makes a positive contribution to national targets in terms of development goals (ITC, 2022). AI can be used to enhance these four characteristics in multiple ways along the NES development process.

The sub-section on (a) creation has a focus on matching national production with international opportunities and defining priority sectors, thus primarily focused on enhancing some supply-side capacities. (b) Implementation mainly addresses aspects to streamline processes and promote exports, therefore focusing on areas considered in the business environment and market-entry components. Finally, (c) evaluation mostly focuses on monitoring and assessing impacts, thus connected to the development and economic outcomes component of the NES. It is important to highlight that the components are interconnected, and thus, AI options affecting one can also impact another. Creation, implementation, and evaluation are also interlinked, particularly with the two last categories requiring planning in the creation stage. To organize the report, these areas are addressed distinctly in the manner previously described, but all four components are important across the three stages.

In addition, the AI options presented and aspects considered within each component do not represent an exhaustive list of ways in which AI can foster international trade. AI offers vast opportunities to enhance trade outcomes and, given the complexity of international trade, its interconnection with other aspects of economic activity, and the breadth of areas covered in the four components, this report must focus on a few key areas. However, it presents many ways in which AI can add value to the creation, implementation, and evaluation of NESs.

In each sub-section, the relevance of a specific trade area or factor in fostering trade and development is addressed, followed by AI possibilities relating to that specific area or factor (such as AI options to create better diversification strategies, for example).
a. Creation of a NES

The focus of the section is on the areas of (i) diversification and expansion of exports, (ii) analysis of national strategies and priority sectors, (iii) assessment of international trade trends, and (iv) analysis of trade agreements. Hence, the section is focused on areas related to the enhancement of supply-side capacities.

i. Diversification and expansion of exports

Strategic export diversification is key for the improvement of export performance. Multiple studies have proven there is a significant link between export diversification and economic growth. Lederman and Maloney (2007) and Hesse (2008), for example, provide robust empirical evidence of export diversification and/or concentration affecting countries’ growth. Al-Marhubi (2000) and Herzer and Nowak-Lehmann (2006), among other empirical studies, find that diversification of exports fosters economic growth.

Hausmann et al. (2005) show that the basket of goods that a country produces, in part determined by comparative advantage but also affected by the underlying cost structure of the economy, may have important implications for economic growth. Evaluating the specialization patterns of relatively similar countries in their analysis, the authors find evidence that countries that export products requiring higher productivity levels tend to have higher rates of economic growth. They conclude that policy can play an important role in economic performance by influencing the industrial structure, and thus, the export basket.

Imbs and Wacziarg (2003) show that the relationship between economic diversification and growth is not monotonic, however, and that countries tend to concentrate on using their natural resources at the early stages of development, then diversifying as they move along the development spectrum, and concentrating their economic activity, once again, in specialized sectors as they reach later developmental stages. There is a U-shaped pattern relating sectoral concentration and income per capita. Relating these findings to trade theory, comparative advantage is dynamic and related to the national developmental situation. Hesse (2008) and Cadot et al. (2011), among other authors, found evidence that supports this finding in the trade context.

The benefits of product diversification extend beyond economic growth, influencing other variables, such as income volatility. Bacchetta et al. (2007), for instance, found that diversification plays a significant role in lowering income volatility for lower-income countries.

The literature is limited but promising regarding incorporating AI into the analysis of export diversification. Che (2020) presents a set of collaborative filtering algorithms that serve as a recommendation engine regarding how to diversify and optimize a country’s long-term export structure. The paper argues AI can aid in adapting a nation’s export diversification strategy for sustainable long-term growth.
and proposes three algorithms to generate a list of product categories that a nation should export: a product-, and a country-based K-nearest neighbors (KNNs),\(^1\) and a Singular Value Decomposition (SVD)\(^2\) algorithm. The author evaluates the systems in two spheres: how correctly the suggestions describe the export basket at present, and how correctly they foresee national export basket changes, in both products and amounts. Conclusions include that the algorithms, particularly the product-based KNN, accurately predict the export trends of the four high-growth countries included in the study in a 20-year period, signaling the systems can be useful in informing the creation and design of trade policies.

In a later paper, Che and Zhang (2021) use a product-based KNN algorithm to generate annual export basket suggestions for 194 economies in a period of 30 years, finding that the countries with export structures that aligned the most with those recommended by the system saw both higher GDP growth rates and lower growth variability. In the paper, the recommendations consist of a list of products that offer insight into what goods a country would benefit from incorporating into their export basket. While expressing that multidimensional analyses are imperative to determine the viability of industries in a country, the authors convey that this tool can be valuable in policy work.

In the business sector, recommendation systems are playing a pivotal role in diversification processes and the expansion of sales. Many companies have implemented recommendation algorithms that help customers identify similar products to those they have bought and for which they might have an interest. A core component of the business strategy of companies like Google, Amazon, and Netflix, among others, is the recommendation engine, which is generally based on deeply layered neural networks. According to MacKenzie et al. (2013), about 35% of what customers bought on Amazon and 75% of what they decided to watch on Netflix was directly related to product recommendations based on the companies’ algorithms. Using these types of algorithm designs for the generation of a NES as opposed to the consumer side can provide countries with information on their export basket selection processes. Recommendation engines can provide information on similar products that can be produced with the same inputs as others, for example, among other possibilities.

Some authors have explored improving export diversification baskets using portfolio optimization methods, which are very commonly used in the finance sector (Labys and Lord, 1990). Brainard and Cooper (1968), following Markowitz’s mean-variance portfolio theory,\(^3\) applied the concept of portfolio analysis to identify the

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\(^1\) KNN is a supervised ML algorithm that can be used for classification and predictions; it uses proximity to classify or predict the grouping of a data point (IBM, n.d.). In this case, the models run on data from multiple countries and products.

\(^2\) SVD is an algebraic technique that is used in recommendation systems, for it allows to decompose a matrix into smaller components that are easier to analyze and use (Tam, 2021).

\(^3\) Theory used to make investment decisions, it is used to analyze the trade-off between risk and reward (Chen, 2021).
optimal export diversification policies in countries. They report countries allocate their resources to produce an optimal export basket that considers the variability and co-variability of the prices of goods at the international level through portfolio diversification theory (Bertinelli et al., 2009). Countries can choose the options based on their level of risk aversion and earning expectations. These analyses have multiple limitations but can provide insights relevant to policies regarding export diversification (Alwang and Siegel, 1994), and AI can assist in implementing these types of analyses, primarily through ML.

AI also offers possibilities to extend algorithms beyond product-based recommendations, focusing on other types of diversification, such as geographical diversification. Bacchetta et al. (2007) show that geographical diversification is relatively more relevant than product diversification for higher-income countries in terms of volatility. Amurgo-Pacheco and Pierola (2008) identified that, in their study of a set of developing countries from 1990 to 2005, exports at the intensive margin\(^4\) accounted for the biggest share of overall trade growth and geographic diversification was more important than product diversification at the extensive margin.\(^5\) Al-driven recommendation systems for geographical diversification can be an intriguing possibility for use in the creation of a NES. Other AI possibilities encompass other aspects of diversification, such as upgrading the quality of products already within the export basket (Brenton et al., 2007).

**ii. Analysis of national strategies and priority sectors**

The creation of a NES can benefit from the knowledge and analysis of existing trade and trade-related national strategies, both at the domestic and international level, and a thorough understanding of the dynamics of priority sectors in the economy.

Analyzing existing export strategies and policies pursued by other countries can be valuable for the creation of a NES, for countries with similar situations can learn from the experience of others. In this context, ITC is conducting a project through which AI is used to identify policy solutions that can address trade barriers and national competitiveness constraints. According to an UNIDO, ITU, and ITC report, the project consists of establishing an AI method based on algorithmic image processing, NLP information extraction techniques, and neural networks that enables policymakers to find trade policy insights or solutions for their situation. With a database of more than 1,500 existing trade strategies, the pilot started in 2020 with a model that was trained to automatically pinpoint content relevant to 21 trade-related topics, which had an accuracy level of 97%. In 2021, the project has implemented a multilanguage chatbot tool to facilitate these insights to SMEs and policymakers across the world, significantly reducing the time needed to find policy solutions (UNIDO, ITU & ITC, 2021). Mining these data provides many opportunities.

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\(^4\) The diversification of exports among products in the export basket (Cadot, 2011).

\(^5\) The diversification of exports by new additions (Cadot, 2011).
for policymakers to create better policies that can further benefit their economies and lead to enhanced development.

In the study of priority sectors within an economy, AI can speed up the processes of data analysis, making valuable information readily available for policymakers. The technology can mine the literature using advanced big-data and NLP models, going through a large number of articles, documents, reports, considering scientific, economic, legal, and other aspects in its processing of information (Gokhberg, 2020). Sectoral data could be collected in one or a set of databases, and software could quickly aggregate relevant information and synthesize it, potentially even running scenarios and offering probability assessments to policymakers.

The range of products that an economy produces and exports is not only determined by its comparative advantages and their changes through time, but also by the entrepreneurs that can be motivated to innovate and engage in new discoveries (Hausmann et al., 2005). Identifying potential exporting firms is an interesting avenue of research that can provide valuable information of priority sectors in an economy. In a paper, Micocci and Rungi (2021) applied ML to predict firms’ ability to start exporting based on the financial accounts of exporters and non-exporters in an economy. They measured the distance of non-exporters from export status based on financial reports of manufacturing firms in France between 2010 and 2018 and had a prediction accuracy of up to 90%.

AI can also assist in the structural transformations of exporting sectors. As the Covid-19 pandemic passes, the international agenda is going towards scaling up climate investment and supporting structural transformation addressing climate change (United Nations Conference on Trade and Development [UNCTAD], 2021). AI can assist in this transformation, running scenarios and bringing forth information relevant to greening processes.

iii. Assessment of international trade trends

Understanding the context of trade transactions is key to building a sound trade strategy. The study of international trade trends provides valuable information for policymakers since these trends have substantial impacts on national economies and their interactions with the globe. In particular, the prediction of international trade trends is crucial to public and private sector decisions; governments and businesses build policies, projects, and budgets on economic growth and trade forecasts.

Literature suggests that AI techniques have the potential to generate more accurate predictions and associations between trade-related factors than econometrical techniques that do not incorporate an AI component. Batarseh et al. (2020) found, for example, after exploring different AI methods to predict international trade trends, that the AI methods in their analysis led to improved predictions than the traditional modelling techniques they tested. Wohl and Kennedy (2018) ran different types of models, concluding that their neural network with
country fixed effects was the model producing the most accurate results. Gopinath et al. (2020) specified that their exploration of supervised and unsupervised ML techniques for predicting agricultural trade patterns showed the high relevance of AI to forecast trade patterns and highlighted that a strength of supervised ML approaches was that they had good fit in the near to medium-term and allowed to identify the variables that play a significant role in determining trade flows. Unsupervised approaches in their analysis had a better fit in the long run. Other papers, like Suler et al. (2021), support the notion that AI techniques have the potential to lead to more accurate predictions than more traditional methods.

Although AI can increase the accuracy of international trade flow prediction, it is important to mention that accuracy is not all that is relevant when considering economic analysis and using AI does not necessarily mean an increase in accuracy. AI methods present limitations and challenges; e.g. depending on the type and complexity of the AI system, it might not be possible to understand of the dynamics through which predictions are generated. More information on this topic will be discussed in Section IV.

Many companies are incorporating AI forecasting into their practices. According to MKC (2017), AI-powered forecasting can decrease errors by between 30% and 50% in supply chain management. The use of AI forecasting techniques is ubiquitous across industries, with firms such as Samsung, Walmart, and Amazon, among others reporting they use ML techniques for their forecasting activities (Dilmegani, 2022; Mahapatra, n.d.; Amazon Web Services, 2021). Intelligent forecasting is one of the top three AI and ML uses in sales (Columbus, 2018).

Technology also has the capacity to provide new information regarding the associations between goods and services exported. Batarseh et al. (2020) portray that AI can effectively identify complementarity and substitutability of products in international transactions, which can have significant implications for policy when one type of good is covered by a tariff, restriction, other type of policy, or sees its stock limited or increased due to a specific situation, such as a drought. They used Association Rules (ARs)6 to discover relationships between variables and show ARs are effective in identifying bilateral associations of this type. If the price of a certain commodity is relatively high, for example, it is likely substitution effects will take place, generating variability in the demand and supply of certain related products to that commodity. Comprehending the dynamics of exports provides insight on how a country can take advantage of opportunities.

Regulation of national and international markets can also reap benefits from AI due to fast and enhanced data gathering and treatment. By generating forecasts that can anticipate and provide more data on trade trends, regulatory frameworks

6 “If-then” statements that can assist in exploring the links between data items and calculating the probabilities of those links; it is widely used to find correlations (Lutkevich, 2020).
concerning those trends could potentially be developed more quickly and easily (International Chamber of Commerce [ICC] – Brasil, 2018).

Regarding policy, Wohl and Kennedy (2018) suggest multiple avenues for future research of AI and trade, such as analyzing the effects of the exchange of goods and services in specific categories, or trade forecast deviation analysis, consisting of studying why some countries and/or sectors deviate from forecasts more than others. Developing knowledge on how a country’s economic growth relates to its trade relationship with its commercial partners through ML is another possible area of research, among others.

iv. Analysis of trade agreements

Trade agreements can have significant impacts on economies. Hence, when planning for and implementing a trade agreement, policymakers must inform themselves on which trading partners, sectors, content, depth level, and provisions will create the most positive outcomes and enhance their understanding of impacts.

Based on the characteristics of countries, researchers have generated models to calculate the probabilities of trade agreement formation between nations. This type of research can help countries find new opportunities, identifying commercial partners and understanding the determinants of trade dynamics with others. Using a traditional probit model, Baier and Bergstrand (2004) found that, based on their multi-country system, they could explain approximately 85% of the 286 Free Trade Agreements (FTAs) in existence in 1996 and 97% of the country pairs with no FTA. Moreover, results included that the likelihood of an FTA between two countries increases the closer in distance they are, the more far away the pair is from the rest of the world, the greater the difference in the capital – labor endowment ratios due from comparative advantage between two nations, the less the difference in capital – labor endowment ratios of the pair relative to that of other countries, and the more economically alike and greater in size that the two trading countries are by exploiting economies of scale of differentiated products. AI can enhance the capabilities of this analysis. Blöthner and Larch (2022), motivated by Baier and Bergstrand (2004), applied tree-based methods and neural networks to predict the probability of the development of regional trade agreements based on certain economic determinants and found higher accuracy levels than the probit model.

In terms of analyzing the effects of trade agreements, AI can be a very valuable tool to analyze and monitor trade agreement provisions, measuring their impacts, and studying the determinants of those impacts, particularly through ML and NLP. Baier et al. (2019) developed a two-stage methodology to study the causes of ex-post effects of FTAs. Results suggest that the impact of FTAs is weaker the farther away countries are from each other, the more ex-ante trade barriers they had with each other, and if they had a pre-existing agreement already in place. Breinlich et al. (2021) implemented a ML method based on a gravity model to identify which provisions of trade agreements particularly affect trade flows. They
found that 43 provisions out of 305 were key to increasing trade between nations in their dataset, and the areas of antidumping, competition policy, technical barriers to trade, and trade facilitation were linked to the trade-strengthening effect of trade agreements. Another approach to making these estimations, which is relatively more traditional, selected 124 provisions as opposed to 43 as being pertinent to increasing trade in this context. The authors highlight the model has limitations and may fail to uncover trade-promoting provisions, but it does identify provision areas that are important and sets the stage for future research in the topic. Possible extensions of this research include exploring the heterogeneity of relevance of these provisions across agreements, estimating their effects on exports with greater detail, among others. In a similar line, Regmi and Baier (2021) applied an unsupervised ML method to capture heterogeneity in trade agreements. Their results indicate that the comprehensiveness of a trade agreement was positively correlated with the estimates of the impact of the agreement, and they specified the areas they found had the most significant impacts on trade generation. AI can significantly contribute to exploring the heterogeneity of provisions and their effects on trade, providing valuable information for policymakers as they create trade strategies and celebrate trade agreements.

AI can assist in the trade negotiation process. In 2017, the World Trade Organization launched the Intelligent Tech & Trade Initiative (ITTI) during its Public Forum. A multimedia project, it is focused on how new technologies, such as blockchain and AI, can facilitate international trade transactions and assist in advancing trade negotiations and agreements (ICC – Brasil, 2018). In a second phase of the initiative, UNCTAD and the Brazilian arm of the International Chamber of Commerce (ICC – Brasil) signed an agreement in 2018 to cooperate in capacity-building, training, research, and analysis projects regarding international trade, which include the implementation of AI and blockchain on trade transactions, operations, logistics, and negotiations (UNCTAD, 2018). In an article, ICC Brazil’s chairman, Daniel Feffer, expressed his certainty that blockchain and AI will boost trade growth, particularly assisting SMEs. The article describes the initiative was building a prototype to use in multilateral trade negotiations (UNCTAD, 2018). Blockchain can help with validating transactions without using a centralized database, and AI can identify and analyze databases, synthesizing relevant information for negotiators of a trade agreement, such as tariffs, barriers to trade, existing agreements between countries, access to public international and national databases, among other data (ICC – Brasil, 2018). The technology can also strengthen negotiation positions by tracking past decisions that can help gain an understanding of parties’ arguments, giving negotiators key input for their work (ICC – Brasil, 2018). The article also reports that ICC was building a prototype in a partnership with IBM, seeking to facilitate bilateral trade agreements. Executive Director of ICC Brazil, Gabriel Petrus, mentioned that the software seeks to match the most appropriate products to offer trade partners and suggest optimal tariffs to highlight opportunities for the parties involved (UNCTAD, 2018).
b. Implementation of a NES

This sub-section addresses the areas of streamlining of processes and the promotion of exports, thus going over some of the components of business environment and market-entry. Some supply-side considerations are also included, such as the streamlining of infrastructure and logistics processes.

i. Streamlining of processes

Technology will expedite procedures along the international trade process and can do so in multiple ways. In the case of AI, administrative procedures can be streamlined, primarily through the analysis of big data and the use of ML and NLP. AI can help manage complaints related to a service, identify key inputs or patterns for an administrative procedure, such as the issuing of patents, or facilitate communication with stakeholders via tools like chatbots that can answer questions regarding administrative procedures. In the area of customs, a report by the WTO and the WCO highlights AI can automate the classification of goods, enhance customs control operations, carry out data mining for risk management, among other tasks. Around half of customs authorities in the world already use a combination of big data analytics, ML, and other types of AI for their work, while the other half plans to incorporate it in the future (World Trade Organization [WTO] & World Customs Organization [WCO], 2022).

AI can also enhance firm export production and supply chain efficiency. A short summary of some of the AI uses in this regard includes demand-forecasting models and integrated business planning that allow for a better understanding of the causes and effects of situations across supply chains (Dilda et al., 2021); AI methods can be used to determine the legitimacy of a trade transaction (Baker, 2021); and incorporating AI to manufacturing processes and systems can enable predictive self-maintenance and rapid adaptation to changing situations (Round Spirit, n.d.). AI can reduce lags in production times by predicting trade trends and reduce timing to delivery. In fact, according to a MKC report, successful implementation of AI techniques for supply chain management has allowed early adopters to reduce the costs of logistics by 15%, inventory levels by 35%, and service levels by 65% in comparison to slower-moving competitors (Alicke et al., 2021). There is significant literature exploring the AI use and potential in value chains, with many papers exploring AI use in sector-specific supply chains.

ii. Promotion of exports

Exporting platforms can be an effective tool to promote national exports, and AI can be useful to set up highly effective systems for this purpose. Technology can improve access to partners and other stakeholders for firms through highlighting personalized opportunities and information relevant to their exports. The Agência para o Investimento e Comércio Externo de Portugal (AICEP), the state agency for promotion of exports and investment of Portugal, for instance, announced in 2019 the launch of a platform called “Portugal Exporta” using AI. Applying ML, big data
and design thinking, the platform offers services tailored to companies, offering them opportunities by matching them with investors and potential partners and customizing their internationalization plans (Gonçalves, 2019). Multiple company internationalization success cases are shared in their website (AICEP Portugal Global, n.d.).

AI-driven marketing tools can be effective to increase exports. AI can identify new customer segments and personalize advertising, providing targeted information that can affect purchasing decisions. Chatbots are also useful tools to promote exports since they make customer-firm interaction by messaging available anytime to anyone with access to the chatbot website. They can be trained to answer questions and offer recommendations about goods and services in different languages, and many provide the option to interact with human customer support staff. In a survey to 500 consumers and business leaders in the US, chatbots were said to increase sales by an average of 67% in 2019 (Yin, n.d.).

Technology can promote exports through minimizing the effects of cultural or language barriers. As an example, the implementation of machine translation systems can lead to an increase in national exports by foreign consumers. Brynjolfsson et al. (2018) found that introducing a machine translation system in the company e-Bay had a significant effect in increasing exports by about 17.5%, with a significant rise in exports to less experienced buyers, cheaper goods, and listing that had more words in their title. Evidence is also consistent with a reduction in time costs of translation-related activities for consumers. National export or trade agencies could benefit from facilitating information in many languages or assisting firms to offer their goods and services in many languages.

AI can allow exporters to learn more about how their behavior in relation to their international customers can affect export performance. Correia de Barros et al. (2009) applied neural networks to understand how the relationship orientation of exporters affects their level of exports. They found that the exporter’s relationship orientation towards international customers positively affects relationship quality, which has a positive impact on export performance. This type of analysis can guide plans to aid companies, especially SMEs, in increasing exports.
c. Evaluation of a NES

This sub-section focuses on the evaluation of the NES regarding development and economic growth, particularly regarding recognizing atypical events and risks to the progress of the NES and measuring NES impacts.

i. Assessment of risks and atypical events

Policymakers must be able to react quickly and appropriately to emergencies and atypical situations, minimizing negative effects. AI can be a very valuable tool in the prediction and measurement of risks affecting NESs and can facilitate an automatic monitoring system that warns of potential risks. Across sectors, technology is currently being used to measure risks. For instance, the supply chain sector uses AI to predict the occurrence of disturbances and mitigate their negative impacts. Companies utilize simulations that go through multiple negative scenarios to build resilience in a diverse set of environments; the simulations can help identify and analyze root causes of delays or other problems and measure their impacts. They can also serve the analysis of the effects of strategic decisions, such as the decision to open or close a factory (Dilda et al., 2021). This can be particularly valuable in the context of emergencies.

ML methods can help estimate a firm or industry’s probability of survival in export markets in the context of an atypical event, such as an economic crisis or a national health emergency. In a paper focused on international trade and the Covid-19 pandemic, Dueñas et al. (2021) estimated the causal effect of the pandemic on the probability of survival of individual Colombian exporting firms each month using data for 2018, 2019, and 2020. Their empirical strategy was to create two supervised ML models, one that was aware of the Covid-19 pandemic, and another one that did not incorporate Covid-19 information, to compare the predictions of both models and document which firms stopped exporting after the pandemic that would have continued exporting in the counterfactual scenario. The authors compared different models against logistic regression results and decided on a logit LASSO model\(^7\) for its performance against other models and relative ease of use. These insights can help policymakers establish policies or projects to assist the companies, particularly SMEs, that are in most need of assistance to survive.

In addition, AI can foster the understanding of the heterogeneity of effects that an economic shock can have in specific industries or exporters with certain characteristics. In the Dueñas et al. (2021) paper, the authors found that, although geographical and product diversification can be a factor that builds firms’ resilience in other contexts, in the April – July 2020 period companies that were more diversified did not necessarily fare better than those with less diversified export baskets. Resilience to the pandemic shock was related to firm size (the bigger firms had a higher survival rate) and the authors were able to identify the sectors most

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\(^7\) LASSO stands for “Least Absolute Shrinkage and Selection Operator;” it is a method to regularize data models and it is used for feature selection (Great Learning, 2021).
affected by the pandemic. These patterns can be identified without the use of AI, but the systematization of this information and the implementation of monitoring systems can easily present these results in a short period of time and live, as policy decision-making processes take place. The authors implemented a regression-tree to capture the non-linearities in the estimated impacts.

Some international organizations are carrying out projects to assess risk through AI. The World Bank is using DL and NLP to obtain information from media regarding famine, which feeds into a model that generates forecasts on future episodes of food insecurity based on the news and other variables (ITU, 2020). This type of model could be used in the context of international trade, recognizing news that can feed into monitoring models. Said models could be designed to inform relevant authorities when a specific trade sector is undergoing high stress due to an atypical event or increased risk.

ii. Monitoring of progress and evaluation of impacts

Data analytics and AI systems can enhance the monitoring of key performance indicators of a NES. ML can process the data and provide inputs for policy in real-time.

The literature indicates that ML, specifically, is extensively being used to classify companies and forecast their performance, which can help identify when firms are in distress. Bargagli Stoffi et al. (2020) have studied how supervised ML has been applied to predict firms’ performance at different moments of their life cycle. They reviewed methods to predict successful startups, forecast growth and development, and identify financial distress leading to the exit of the market of firms. A list of papers that cover applications of ML for predictions at the firm level in each of these life cycles is included in their research, with a description of the type of ML method and dataset used, and the goodness of fit of the model.

AI can also add value in understanding the role that exports play in economic growth and development. The literature has extensively studied the relationship between exports and GDP expansion and development. However, some studies incorporate AI techniques to improve the predictive power of models. Shaaf and Ahmadi (1999), for example, used neural networks to investigate the role of exports in the economic growth and development of Malaysia, and found that exports were strong contributors to both variables.
IV. Important considerations, challenges, and risks of AI adoption in the context of a NES

There are important considerations, challenges, and limitations related to the incorporation of AI technology in the development process of a NES. This section highlights key considerations at the macro-level dimension, followed by several technical considerations for AI adoption.

a. Macro-level dimension

While AI is developing at an incredibly fast pace, its adoption raises ethical concerns, such as regarding privacy or generalized automation of complex processes that can lead to unethical outcomes, among others. Establishing ethical AI and AI-related activities that respect international and national policies, regulations, and standards is of critical importance. A prominent international standard for AI is the set of AI OECD principles, which were adopted by 42 governments in 2019 (OECD, 2019). The principles are accompanied by policy recommendations and highlight the importance of (1) inclusive growth, well-being, and sustainable development, (2) human-centered values and fairness, (3) transparency and explainability, (4) robustness, safety, and security, and (5) accountability of AI (OECD, n.d.). In 2021, the 193 Member states of UNESCO adopted a recommendation on common principles and values to ensure an ethical development of AI. The agreement provides a guide to ensure that AI-related transformations promote human rights and the achievement of the SDGs (UN, 2021).

It is also crucial that all countries can take advantage of these technologies. According to a paper by the ITTI, developing countries would especially benefit from AI access and adoption to continue developing their competitive advantages (ICC – Brasil, 2018). However, for many, the adoption of AI can be a significant challenge: it implies having internet, data, and computing infrastructure, planning, deploying, and maintaining systems, and investing in R&D and skill-building, among other implications. According to an UNIDO, ITU, and ITC report, the main barriers that SMEs in developing countries face in adopting and using AI are (1) implementation costs, (2) skill development, gender imbalance, and capital-skill complementarity issues, (3) company infrastructure adaptation and standardization-process costs and efforts, (4) relatively limited opportunities for partnerships compared to larger companies, (5) managing ethical concerns related to the adoption of AI, (6) complying with regulations and standards, (7) and social and cultural barriers (UNIDO, ITU & ITC, 2021). The nations that are actively taking steps to adopt AI or that can relatively easily adopt it will very likely see their competitive advantages enhanced in a short timeframe, which can widen the gap between developing and developed nations.

To overcome the barriers to AI adoption for SMEs in developing countries, national strategies, policies, and frameworks are important to support positive AI adoption (UNIDO, ITU & ITC, 2021). Global efforts to foster technological capabilities,
technology-related cooperation, and implementation of best practices can also assist in achieving better economic and development outcomes. Multilateral organizations play a key role in generating resources and an environment in which the gap between developed and developing nations in relation to the use of AI in international trade can be reduced, supporting countries with fewer resources to overcome obstacles to robust AI adoption that can promote positive outcomes.

b. Data availability and management

When implementing an AI system, a key component for its success is having availability of large datasets that are high quality and relevant to the objective of the system. The scarcity of data in relevant areas to international trade can challenge the use of ML and other AI methods in the development of a NES. Generating and/or obtaining relevant data and improving the quality of existing data for AI systems require planning, analysis, and actions by relevant stakeholders.

The formatting of data is also a relevant challenge: data that is not available in a relational format is very difficult to incorporate to a data ecosystem to be analyzed by AI methods. According to Bughin et al. (2017), much of the data generated in industry at present is “flat data,” meaning it has no relational structure. In fact, in manufacturing, an estimated 90% of data is “flat” (MKC, 2017). To make this data readable and usable by AI systems, organizations must adopt approaches that can efficiently handle big data (Bughin et al., 2017).

There are also challenges in terms of data management and storage. Determining the process through which vast amounts of data will be managed is a challenging endeavor requiring expertise, and data storage implied ensuring a sustainable infrastructure that can hold the necessary data, determining security and accessibility protocols, selecting level of data granularity, among other decisions.

c. System definition and interpretability

The specification of an appropriate AI system that appropriately feeds off the correct data, processes it aptly, and generates results with high levels of accuracy in line with the goals of a project and standards is key for AI to add value to processes. Not any AI methods will fit a project, or any model specifications will align with an objective. A careful analysis and testing of models are important to verify results.

The extended implementation of many AI methods is challenged by the opaque nature of its processes, which do not lay out the rationale behind their recommendations (Che, 2020). Many AI methods can be perceived as a “black box,” either due to their complexity or due to systems being proprietary and not making technical documentation available (Rudin, 2019). In terms of the complexity channel, there is no set threshold referring to when a model transforms into a “black box”; simple models such as linear regressions can be easily interpreted, but complex models such as multi-layered deep neural networks, which can have a very high number of parameters, may not be interpretable (Perteneder, 2021). This introduces risk to decision-making based on that
information. Regulations, policies, and standards play a big role in determining the degree to which “black boxes” can provide solutions across industries and sectors.

Rudin (2019) highlights that the interpretability provided by relatively simple AI models, such as straightforward ML models, can be more valuable than the enhancement in performance gained from highly complex AI systems. She discusses that the assumption that there is necessarily a trade-off between accuracy and interpretability of models is not correct, for even in applications in which DL has significant performance gains, some forms of interpretability can be instilled into the models without losing accuracy. She highlights that the importance of the interpretability of models increases as the importance of the decision-making process increases, and that interpretability should be a key consideration when implementing an AI system.

d. Adoption costs and AI talent needs

The cost of AI implementation can be a significant limitation to its adoption. According to a report by UNIDO, ITU, and ITC (2021), in the business sphere, the cost of AI remains a major challenge, especially for SMEs. Initial investments required to set up and use AI systems demand several resources that can be expensive, time-consuming, and difficult to acquire. Furthermore, the cost can be directly associated with functionality and algorithm processing performance, for example, by implementing a personalized solution instead of a pre-built solution (UNIDO, ITU & ITC, 2021).

Furthermore, AI human capital is needed to create, implement, and maintain AI and data systems, and AI talent is limited and in short supply worldwide. A report by Deloitte Insights (2020) on their AI in the Enterprise survey highlights that 68% of executives surveyed informed of a moderate-to-extreme AI skills gap, and 27% classified their gap as “major” or “extreme”.

e. Risk management and mitigation

To successfully adopt AI at scale, the experience of organizations highlights the importance of following best practices and minimizing risks. According to a MKC 2021 survey, the management of AI risks is an area for substantial improvement. The AI risks that organizations considered most relevant in 2021 were cybersecurity, regulatory compliance, explainability, personal/individual privacy, organizational reputation, equity and fairness, workforce/labor displacement, physical safety, national security, and political stability (Chui et al., 2021).

The survey also provides information on AI risk management practices. Organizations obtaining the highest returns from AI engage in risk-mitigation practices more often than others: top AI performers are more likely to engage in scanning training and testing data to check for the underrepresentation of relevant characteristics or attributes, skewed or biased data, retrain models when issues are detected, monitor data and/or concept drift, including a human-in-the-loop verification phase of model deployment, documenting model architecture, among other practices (Chui et al., 2021).
V. Conclusions & Recommendations

Technology can be an invaluable tool to shape NESs for inclusive development, supporting countries in expanding horizons, facilitating processes and access to new opportunities, and assisting in monitoring and evaluation. Based on a literature review, use cases by organizations, and expert interviews, this report finds multiple key ways in which AI can assist in the process of a NES for economic growth and development.

In summary, AI can add value to the following processes:

<table>
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<tr>
<th>a. Creation</th>
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<tr>
<td>1. Diversification and expansion of exports</td>
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<tr>
<td>➢ Creation of a multidimensional diversification plan to optimize the export structure</td>
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<td>➢ Identification of diversification insights based on the variation of the prices of goods</td>
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<tr>
<td>2. Analysis of national strategies and priority sectors</td>
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<tr>
<td>➢ Provision of trade policy insights and solutions for a national context or situation</td>
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<td>➢ Collection, analysis, and synthesis of information for the determination of priority sectors</td>
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<td>➢ Prediction and identification of potential exporters</td>
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<td>➢ Structural transformation of exporting sectors</td>
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<td>3. Assessment of international trade trends</td>
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<tr>
<td>➢ Forecasting of trade trends</td>
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<tr>
<td>➢ Identification of complementarity and substitutability of products</td>
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<td>➢ Prediction for the need for regulatory frameworks in specific areas</td>
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<td>➢ Trade deviation analysis</td>
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<td>➢ Knowledge gain on the trade dynamics with commercial partners</td>
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<td>4. Analysis of trade agreements</td>
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<td>➢ Probability estimation of trade agreement formation</td>
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<td>➢ Analysis, monitoring, and knowledge gain on the impact of trade agreement provisions</td>
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<td>➢ Facilitation of the trade agreement negotiation process</td>
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<th>b. Implementation</th>
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<tr>
<td>1. Streamlining of processes</td>
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<td>➢ Simplification of administrative procedures</td>
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<td>➢ Facilitation of communication to complete processes</td>
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<tr>
<td>➢ “Smart” automatization of activities</td>
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<tr>
<td>➢ Enhancement of production capabilities</td>
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<td>➢ Reduction of procedural costs</td>
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<tr>
<td>2. Promotion of exports</td>
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<tr>
<td>➢ Provision of export promotion services tailored to companies</td>
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<tr>
<td>➢ Marketing and advertising</td>
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<td>➢ Reduction of cultural and language barriers to markets</td>
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<tr>
<td>➢ Knowledge gain on business best practices for international trade</td>
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<th>c. Evaluation</th>
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<tr>
<td>1. Assessment of risks and atypical events</td>
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<tr>
<td>➢ Prediction and measurement of risks</td>
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<tr>
<td>➢ Knowledge gain and data point collection regarding risks</td>
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<tr>
<td>➢ Analysis of the effects of strategic decisions, including emergencies</td>
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<tr>
<td>➢ Estimation of the survival of companies in challenging environments</td>
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<tr>
<td>➢ Understanding the heterogeneity of effects of an economic shock</td>
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<td>2. Monitoring of progress and evaluation of impacts</td>
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<tr>
<td>➢ Monitoring of key performance indicators</td>
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<tr>
<td>➢ Identification and data on the distress of firms or sectors</td>
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<tr>
<td>➢ Knowledge gain on the role that trade plays in economic growth and development</td>
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</table>
As AI adoption grows, the challenges and risks associated with its use also gain prominence. According to the AI index report 2022, AI is becoming more affordable and higher performing. However, language models are increasingly becoming more biased and the systems generating top results as determined by technical benchmarks tend to rely on the use of extra training data (Zhang et al., 2022). A significant challenge for governments is the design and implementation of AI regulations, frameworks, and policies to address the ethical issues related to AI use. Promoting equity in access to the opportunities of AI among and within countries is also a significant challenge. Data availability and management, the definition of systems and their interpretability, the costs of adoption and fulfilling AI talent needs, and managing and mitigating risks can also be challenging endeavors related to AI adoption.

The present work highlights a few high-level actions points that can be helpful in the adoption of AI to add value to the creation, implementation, and evaluation of NESs:

1. Evaluation of the AI methods that can aid in the NES process and incorporation of those that are viable for the context and have a high likelihood of providing valuable input.

   AI can be a valuable tool for the development of NESs. Considering that implementing AI systems is a process that requires various resources, such as large datasets, highly qualified staff, and computing power, among other requirements, the incorporation of AI systems will depend on the resources available and the benefits they can bring to a process. The use of AI is growing across sectors, and in particular, evidence suggests the use of ML and NLP techniques in the context of international trade is growing. AI, and ML and NLP particularly, hold high potential to add value to the NES process.

2. Generation of a strategy to address the challenges and risks associated with the AI methods used in the creation, implementation, and evaluation of NESs.

   The adoption of AI includes challenges and risks that range from issues of data formatting to ethical considerations. Devising a strategy to address these is key to achieving a robust AI system that fosters trustworthiness and is in line with national and international standards.

3. Incorporation of AI considerations to the NES, setting the foundation for future development of AI uses.

   Given the impact the incorporation of AI is having around the world, it is advisable that NESs include considerations regarding preparing for the growth and more extended use of AI in the international trade sector, such as through fostering rules and frameworks for the technology, establishing the generation of new statistics, promoting AI research, development, and training, among other possibilities.
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Appendix

List of experts interviewed

- Emmanuelle Ganne, international trade expert, currently Senior Analyst in the Economic Research Department at the World Trade Organization (WTO).
- Marco Morucci, expert in data science methods, currently Moore-Sloan faculty fellow at New York University’s Center for Data Science.
- Laura Sallstrom, expert in technology policy, currently Adjunct Instructor in the Sanford School of Public Policy, Duke University.