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**Unlocking Supply Chain Efficiencies in Export and Import:
The Contribution of Modern Technologies/Startup project on BORDERLESS**

A thesis submitted in partial fulfillment of the requirements for the degree of
Master of Human Resources Management, to complete the sections for an academic
Master.

by

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Dedication

With all my due respect and gratitude, I would take a moment to dedicate this thesis to my beloved parents, who have been always my inexhaustible source of inspiration and strength, whom continually provide their moral, spiritual, emotional, and financial support.

To my pride, my wonderful sisters, **Ing. Nejatt Cheikh Mohamedhen** and **Dr. Mariem Cheikh Mohamedhen**.

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Abstract

This study explores the role of modern technologies in enhancing supply chain efficiencies within the context of international trade, with a direct projection to it, on a critical startup project. The increasing complexity of global trade operations has exposed numerous inefficiencies in traditional supply chains, including delays, lack of transparency, high operational costs, and poor coordination among stakeholders. Addressing these challenges requires a shift toward technology-enabled solutions that can automate, optimize, and secure trade flows across borders.

The methodology adopted is qualitative in nature, utilizing data analysis from academic sources, industry reports, and company publications. A thematic approach is used to examine how some particular technologies contributes to specific dimensions of supply chain performance.

Key findings indicate that AI-driven forecasting tools, blockchain-enabled transaction transparency, and IoT-based tracking systems have collectively led to significant improvements. The research highlights not only the benefits but also the challenges of implementing such technologies, including regulatory constraints and infrastructure limitations in emerging markets. The study concludes with practical implications for policymakers, logistics providers, and exporters aiming to harness digital transformation for competitive advantage.

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List of Abbreviations and Glossary

AI – Artificial Intelligence

A field of computer science that focuses on creating systems capable of performing tasks that require human intelligence, such as decision-making, learning, and problem-solving.

B2B – Business-to-Business

Commercial transactions or relationships between two businesses, as opposed to between a business and a consumer.

B2C – Business-to-Consumer

Transactions conducted directly between a company and consumers who are the end-users of its products or services.

ERP – Enterprise Resource Planning

Software systems that integrate and manage core business processes such as finance, HR, manufacturing, and supply chain.

IoT – Internet of Things

A network of interconnected physical devices embedded with sensors and software to collect and exchange data.

ML – Machine Learning

A subset of AI that enables computers to learn from data and improve their performance over time without being explicitly programmed.

SCM – Supply Chain Management

The management of the flow of goods and services from raw material sourcing to end-user delivery, including logistics, information, and financial flows.

SMEs – Small and Medium-sized Enterprises

Businesses with a limited number of employees and revenue, playing a crucial role in economic growth and innovation.

SWOT – Strengths, Weaknesses, Opportunities, and Threats

A strategic planning tool used to identify the internal and external factors that may impact a project or organization.

TAM – Technology Acceptance Model

A theory that models how users come to accept and use a technology based on perceived usefulness and ease of use.

SCOR – Supply Chain Operations Reference Model

A process reference model developed to evaluate and improve supply chain performance.

R&D – Research and Development

Innovative activities undertaken by companies to develop new products or improve existing ones.

EDI – Electronic Data Interchange

The digital exchange of business documents and information in a standardized electronic format between trading partners.

WMS – Warehouse Management System

Software applications designed to support and optimize warehouse functionality and distribution center management.

Introduction

Background

Global trade has experienced exponential growth in the past few decades, driven by globalization, liberalized markets, and advancements in information and communication technologies. At the heart of international trade lies the supply chain—a complex network that coordinates the movement of goods, information, and finances across borders. Supply chain management (SCM) plays a critical role in ensuring timely delivery, cost efficiency, and customer satisfaction, especially in export and import operations. However, as supply chains have become more global and interconnected, they have also become more vulnerable to disruptions, inefficiencies, and bottlenecks.

Problem Statement

Despite the technological progress in manufacturing and commerce, traditional export/import supply chains often remain plagued by inefficiencies. One of the principal challenges in managing international supply chains is maintaining cost efficiency, particularly in an environment where transportation expenses, customs duties, and inventory holding costs vary widely across region.

These include delayed customs processing, due to port congestion, geopolitical instability, or fragmented logistics systems frequently disrupt production and distribution schedules. Also, poor inventory visibility, fragmented logistics systems, and limited coordination between stakeholders. The need for regulatory compliance across jurisdictions, especially in sensitive sectors like pharmaceuticals, food, and electronics, further adds to the complexity.

The COVID-19 pandemic further exposed these structural weaknesses, as global trade was disrupted by labor shortages, transportation delays, and border restrictions. This scenario has underscored the urgent need for resilient, agile, and technology-enabled supply chains that can withstand external shocks and adapt to dynamic market conditions.

Rationale

In the post-COVID era, the digital transformation of supply chains is no longer a strategic option but a necessity. Emerging technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), blockchain, big data analytic, ERP systems, and predictive analytics are transforming traditional supply chains into intelligent, adaptive systems. These tools allow for real-time tracking, demand forecasting, automated compliance, and integrated planning across organizational boundaries. Moreover, it offers the potential to revolutionize traditional SCM practices by enhancing transparency, improving decision-making, and reducing lead times.

In response to these challenges, many firms are turning to modern digital technologies as enablers of greater agility, visibility, and resilience.

This thesis explores a central research question, that goes:

How do modern technologies improve supply chain efficiencies in export and import operations?

Sub-questions:

- ✓ What does the global supply chain stand for?
- ✓ What kind of modern technologies, that we can use to enhance supply chain?

- ✓ How do export and import activities operate?
- ✓ What are the intersections between modern technologies, supply chain management, and the export-import activities?
- ✓ What are the future tendencies of the contributions of modern technologies in SCM, particularly in transit operations?

Hypothesis:

“Modern technologies significantly enhance efficiency in supply chain operations related to export and import activities by improving logistics coordination, transparency, and operational speed.”

This hypothesis draws on existing research indicating that digital tools yield measurable performance gains. For instance, systematic reviews have found that IoT and AI applications in manufacturing supply chains improve automation and data availability, which in turn enhances overall SCM efficiency. Similarly, prior studies report that technologies like blockchain and IoT increase transparency and reduce delays in international logistics. By testing this hypothesis, the research seeks to confirm whether such benefits apply generally to export/import logistics, using the collected secondary evidence.

Objectives

To address the research question, the following research objectives are proposed:

- 1. To identify the key digital technologies currently applied in global supply chains.**

2. To evaluate the impact of these technologies on supply chain performance metrics, including:

- Cost efficiency
- Transparency and traceability
- Operational speed and responsiveness
- Sustainability and regulatory compliance

Given the multifaceted and dynamic nature of supply chains, this study adopts a qualitative, case-based research methodology. A case study approach is particularly suited for analyzing the contextual and organizational variables that influence technology adoption and outcomes. It allows for in-depth investigation of real-world practices and the complex interdependencies between technological, human, and institutional factors.

To analyze the key challenges facing traditional export/import supply chains.

1. To explore the role of modern technologies (AI, IoT, blockchain, etc.) in addressing these challenges.
2. To evaluate the effectiveness of these technologies in enhancing supply chain efficiency.
3. To identify transferable lessons and recommendations for other firms and policymakers.

Scope and Limitations

This study is limited to a qualitative data analysis that focuses primarily on export/import operations and technology applications in SCM. The research relies

on the latest previous studies including company reports, academic literature, and industry analyses.

Structure of the Thesis

This thesis is organized into two fundamental sections:

- I. Theoretical and Methodological part
- II. Analytical part: (Startup project) BORDERLESS

The first part includes three chapters:

- Chapter 1 shows the complete structure of research methodology, and provides a clear understanding to theoretical framework, introducing the fundamental concepts of supply chain management, including its structure, performance indicators, and theoretical models such as Lean, Agile, JIT, RBV, and TCE. Shedding the light on export and import activities. Moreover, the role of modern technologies in enhancing supply chain performance, highlighting tools such as blockchain, IoT, ERP systems, AI, and automation platforms. Concluding this chapter by the relationship between the three main variable, modern technologies, supply chain management, export and import activities.
- Chapter 2 presents the applied literature on study variables, discussing some local and international previous studies, and the relationship between them and the current one, outlines the similarities and differences, and the added value of this study.

The second part on the startup project “**Borderless**”: this part provides a complete study to the project. Including technical data, business plan, financial studies, BMC, and the prototype by the end of this part.

This study aims to contribute to both academic and managerial understanding of how digital transformation can unlock efficiencies, agility, and sustainability in global supply chain operations, and particularly in export and import activities.

Finally, concludes the study with key takeaways, policy recommendations, and suggestions for future research.

PART I – THEORETICAL AND METHODOLOGICAL FRAMEWORK / APPLIED LITERATURE

Chapter 1: Theoretical and Methodological Framework

This chapter outlines the theoretical and methodological framework underpinning this research., It begins by elucidating the methodological approach is detailed, clarifying the research design, data collection strategies, and analytical techniques employed. This section justifies the chosen methods by demonstrating their appropriateness for addressing the research questions and achieving the study's objectives. Subsequently, the core theories and concepts that guide our understanding and analysis of the research problem, providing a robust intellectual foundation for the study Together, the theoretical and methodological frameworks establish the rigorous and systematic approach taken in this thesis, ensuring the credibility and validity of the findings.

Research Methodology

- shows the complete structure of research methodology, starting by research design, unit of analysis, source of data, technique of data collection, and finalized by technique of data analysis, and analytical approach.

Research Design

The study adopts a qualitative case - based design, using an analytical - descriptive approach combined with comparative analysis. This approach is well suited to exploring complex, real - world supply chain contexts and the multifaceted impact of technology. By examining multiple documented cases (industry and sector examples), the research can delve into the contextual and organizational

factors that influence how innovations like IoT, blockchain, and AI are adopted in export-import logistics. Qualitative methods allow in - depth investigation of how these tools change coordination, transparency, and speed in global supply chains, compared to traditional practices.

Unit of Analysis

The primary units of analysis are secondary data sources – specifically, documented case studies and texts that shed light on supply chain operations. These include published project reports, industry analyses, and illustrative examples from exporting and importing companies. In practice, each case study or document (e.g. a journal article or white paper) is treated as a separate unit for analysis. This unit - of - analysis strategy allows the researcher to compare across multiple cases and identify common themes and differences in how technologies improve efficiency.

Source of Data

Data are drawn exclusively from secondary sources, encompassing a broad range of documentation. Key data sources include:

- Peer-reviewed research papers and academic theses on supply chain and logistics technology. These published studies provide evidence on the effects of digital tools in export-import contexts.
- Government and institutional reports, such as official trade analyses and policy documents. These often contain case reports and statistics on logistics performance and technology use.
- Industry white papers and corporate case studies from logistics firms and technology vendors, which describe practical implementations of IoT, blockchain, etc.

- Institutional databases and archives, including international trade databases and reports by organizations (UN, World Bank) that document supply chain metrics.

Each source is selected for its relevance and credibility. Governmental and institutional reports provide authoritative data, while academic and industry publications offer rigorous analysis and examples of technology impact. Prior studies are explicitly treated as data: as Bowen notes, researchers often “review prior literature” as data, with previous studies serving as sources to be interpreted.

Technique of Data Collection

The data collection relies on document review and non-participant observation of existing materials. In practice, this means systematically gathering and reviewing relevant documents rather than collecting new field data. Document review involves identifying, selecting, and cataloging texts such as case studies, technical reports, and scholarly articles. As Khalid et al. note, document analysis (or review) is one of the most commonly used qualitative methods and is essential in studies of complex systems.

This step serves to compile all pertinent information on how technologies are applied in export/import supply chains.

Non-participant observation is used in a broad sense: the researcher observes and notes information from documents without engaging in any active manipulation. In this context, “observation” means reading and interpreting the material; the researcher does not conduct interviews or participate in logistics operations. This approach matches the “fly on the wall” strategy: the researcher remains detached, focusing on the content of texts and reports as they exist. By combining these

methods, the study collects a rich body of secondary evidence while minimizing researcher bias.

Technique of Data Analysis

Data analysis is performed using content analysis supplemented by comparative analysis. Content analysis is employed to code and categorize information from the collected documents. In this process, text passages from each source are systematically examined to identify recurring words, themes, or concepts (for example, mentions of “traceability,” “lead time,” or “coordination”). Excerpts and quotations are extracted and organized into thematic categories such as logistical coordination, transparency measures, and speed improvements. As Bowen describes, document analysis (as content analysis) entails “finding, selecting, appraising, and synthesizing data contained in documents,” yielding data that are then arranged into major themes or case examples.

Comparative analysis then contrasts these findings across different cases and sources. By examining how each technology is reported to affect efficiency in multiple contexts, the study identifies patterns and differences. For example, the analysis may compare case studies from different industries or countries to see if blockchain consistently improves transparency. This cross-case comparison helps triangulate findings and increases confidence in the conclusions. In combination, content and comparative analysis enable a rich, narrative synthesis of how modern technologies shape export/import supply chain efficiency.

Theoretical Framework

Unlocking Supply Chain Efficiencies in Export and Import: Modern Tech and “Borderless” Innovation

Introduction

Global supply chains for export and import are increasingly leveraging modern technologies to become more “**borderless**” – minimizing friction at international frontiers. Advances in artificial intelligence (AI), blockchain, Internet of Things (IoT), automation, and data analytics are streamlining logistics, speeding up customs clearance, improving inventory management, and enhancing transparency across borders. This report reviews key academic and industry studies on these technologies’ impact, highlights real-world startup-driven innovations that have delivered efficiency gains and risk reduction, and discusses major trends and debates in the digital transformation of global supply chains (especially in developing regions). A comparative table of technologies, use cases, and impacts is included to summarize findings.

Fundamentals of Supply Chain Management

1. “The network of organizations, people, activities, information, and resources involved in moving a product or service from supplier to customer.”¹
2. “The management of flows of goods, information, and finances as they move from raw-material suppliers through factories and warehouses to the end customer.”²

¹ Supply Chain Management: Strategy, Planning, and Operation, Sunil Chopra & Peter Meindl, 7th ed., 2020.

² Logistics & Supply Chain Management, Martin Christopher, 5th ed., 2016.

3. “All the interconnected processes and partners that add value at each stage, from sourcing inputs to delivering finished products to end-users.”³

4. “A system of organizations, people, technology, activities, information, and resources involved in the creation and delivery of a product or service.”⁴

5. “The coordination and integration of procurement, production, distribution, and logistics activities across a global network.”⁵

The globalization of trade, the rise of digital technologies, and increasing customer expectations have made supply chain management (SCM) a central discipline in the strategic operations of modern organizations. In an international context marked by growing complexity, volatility, and interdependence, the ability to manage supply chains effectively is not only a source of competitive advantage but a requirement for operational survival.

Modern Technologies Driving Cross-Border Supply Chain Efficiency

1. “The application of scientific and engineering principles to design and operate efficient manufacturing processes, tools and systems.”⁶

³ Essentials of Supply Chain Management, Michael H. Hugos, 3rd ed., 2018.

⁴ Introduction to Operations and Supply Chain Management, Cecil C. Bozarth & Robert B. Handfield, 4th ed., 2019.

⁵ Global Logistics and Supply Chain Management, John Mangan, Chandra Lalwani & Tim Butcher, 3rd ed., 2016.

⁶ Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Mikell P. Groover, 5th ed., 2019.

2. “The ensemble of digital and physical artifacts—software, hardware, networks—and their integration into social and organizational contexts to solve real-world problems.”⁷

3. “A set of advancements—cloud computing, big data analytics, Internet of Things, and artificial intelligence—whose convergence enables firms to re-engineer their business processes.”⁸

4. “The fusion of cyber-physical systems, smart automation, and data-driven decision-making in manufacturing and logistics, often referred to as Industry 4.0.”⁹

5. “Innovations that disrupt existing markets by creating new value networks—often displacing established technologies—through novel products, services, or processes.”¹⁰

Key performance indicators (KPIs) in SCM: cost, time, flexibility, quality, resilience

In the field of supply chain management, total logistics cost is considered one of the most strategic key performance indicators (KPIs). It serves to evaluate the overall economic efficiency of the supply chain by measuring the sum of all expenses incurred to move a product from the supplier to the final customer, across the various stages of the international logistics network.

⁷ Technology and Society: Building Our Sociotechnical Future, Deborah G. Johnson & Jameson M. Wetmore, 2010.

⁸ Digital Transformation: Survive and Thrive in an Era of Mass Extinction, Thomas M. Siebel, 2019.

⁹ Industry 4.0: The Industrial Internet of Things, Alasdair Gilchrist, 2016.

¹⁰ The Innovator’s Dilemma: When New Technologies Cause Great Firms to Fail, Clayton M. Christensen, 1997.

Procurement Costs

Procurement costs refer to all expenses incurred to acquire the goods, materials, and components necessary for production or distribution within a supply chain. These costs often represent a significant portion of the total supply chain expenditure and directly influence a company's competitive position in global markets.

1.1 AI and Automation in Logistics Operations

Artificial intelligence and automation are revolutionizing how goods move globally by optimizing routes, improving warehousing, and reducing manual effort. **AI-powered analytics** enable more accurate demand forecasting and dynamic route planning, ensuring shipments travel by the fastest, most cost-effective paths. For example, AI-driven route planning tools can factor in real-time data on traffic, weather, and fuel costs to recommend optimal shipping routes, sometimes even deploying autonomous vehicles to cut human error and labor costs for long-haul transport. Major logistics providers like DHL and ocean carriers like Maersk have deployed AI to **optimize operations and improve efficiency**, confirming significant benefits in practice.

In warehousing, **automation technologies** (robotics, conveyor systems, automated guided vehicles) handle repetitive tasks such as picking, packing, and sorting with high speed and precision. This not only accelerates order fulfillment but also supports real-time inventory tracking, preventing stock imbalances and improving space utilization. Automated systems can operate 24/7, increasing processing capacity and consistency while reducing dependency on manual labor. Overall, automating data capture and material handling minimizes human errors in labeling, order entry, and shipping coordination – leading to fewer lost or misrouted

items and nearly eliminating paperwork mistakes. Integration of processes from ordering to delivery (through enterprise platforms and robotics) has **shortened end-to-end delivery timelines**, as orders are automatically verified, routed, and prepared with minimal human intervention. These AI and automation applications yield faster cycle times, lower logistics costs, and more resilient operations, all crucial for cross-border trade efficiency. Notably, **predictive analytics** (often considered a subset of AI) further contributes by processing historical and real-time data to anticipate demand surges or potential delays, allowing proactive adjustments in production, inventory, and transportation plans.

1.2 Streamlining Customs Procedures with Digital Technologies

Customs clearance is a notorious bottleneck in cross-border supply chains, involving complex documentation and inspections. Modern technologies are **digitizing and automating customs procedures** to reduce delays and costs. *Blockchain* has emerged as a game-changing tool for customs digitalization, enabling secure, shared data networks for all trade stakeholders. By connecting ports, carriers, freight forwarders, customs brokers, and authorities on a permissioned blockchain ecosystem, international trade and customs processes can be **revolutionized** through real-time data sharing. For instance, a blockchain-based platform can allow exporters, importers, and customs to **share and track trade documents in real time**, creating data-driven customs that can better combat illegal trade and fraud. Smart contracts (self-executing code on blockchain) can even automate the collection of duties and trigger clearance as soon as a shipment fulfills pre-defined conditions – for example, automatically releasing a shipment or payment when an IoT sensor confirms a truck has crossed the border. Studies indicate that such blockchain solutions fundamentally improve the *speed, cost, and manner* of customs clearance by reducing human intervention and providing a single source of

truth for shipment data. Indeed, customs efficiency directly affects the cost and duration of trade transactions, so digitizing border processes has high impact.

Beyond blockchain, **AI and risk analytics** are being deployed in customs for smarter inspections. Machine learning models analyze shipment data to profile risks and **identify which consignments need inspection**, allowing low-risk cargo to clear faster. At the same time, **IoT-enabled “smart borders”** are improving oversight without slowing trade. *Smart security devices* – such as connected seals, GPS trackers, and RFID tags on containers – feed real-time location and integrity data to customs systems. This helps customs officers remotely monitor cargo integrity and **prioritize inspections based on real-time risk analysis**, facilitating legitimate goods’ movement while targeting suspect shipments. The World Customs Organization (WCO) reports that such IoT-based smart locks and sensors can streamline cargo supervision and clearance, giving authorities tools to clear goods more efficiently without compromising security. For example, if a container’s smart seal reports no tampering and matches its digital manifest, it may bypass a physical inspection, cutting border dwell time. **Digital Single Window** systems are another critical technology: these government platforms allow traders to submit all documents and data through one portal for all agencies, drastically simplifying compliance. A study in Costa Rica showed that an electronic single-window yielded \$16 in economic gains per \$1 invested, with trade using the single window growing 1.4% faster than via paper processes. Overall, digitization of customs – through blockchain data exchanges, AI risk management, IoT monitoring, and single windows – is accelerating cross-border throughput and reducing red tape in trade. Academic and policy research strongly underscore that embracing such technologies is essential for **“borderless” trade facilitation**.

1.3 Optimizing Inventory Management with IoT and Predictive Analytics

1.3.1 Key Applications of IoT in SCM

1. Live Tracking of Shipments and Vehicle Fleets

One of the most impactful applications of IoT in logistics is **real-time geolocation tracking** using **GPS-enabled sensors**. Fleet vehicles, shipping containers, and even individual packages can be continuously monitored throughout their journey across countries or continents. This provides:

- Accurate Estimated Time of Arrival (ETA) updates,
- Early detection of route deviations, theft, or tampering,
- Enhanced security and customer transparency.

For example, Maersk, a global shipping leader, uses IoT-equipped containers to monitor the movement and condition of goods in transit, enabling precise control over global inventory flows.

2. Environmental Condition Monitoring

IoT sensors can monitor **critical environmental variables** such as temperature, humidity, pressure, and shock impact—especially important in the transport of **perishables, pharmaceuticals, or sensitive electronics**. Real-time data alerts allow firms to:

- Respond immediately to deviations (e.g., if a refrigerated unit fails),
- Ensure product quality upon delivery,
- Comply with strict international safety and health regulations (e.g., FDA or EU standards).

Such applications are widely used by cold chain providers like DHL and UPS in industries including food, medicine, and biotechnology.

3. Predictive Maintenance of Logistics Assets

IoT also facilitates **predictive analytics** through continuous equipment monitoring. Sensors embedded in trucks, conveyor systems, or cranes collect data on usage patterns, vibrations, temperature, and wear. AI algorithms then analyze this data to predict when parts are likely to fail or require maintenance. This helps reduce:

- Unplanned downtimes,
- High repair costs,
- Disruptions in shipping schedules.

In large-scale port and warehouse operations, predictive maintenance has proven critical in sustaining uptime and operational reliability.

Strategic Benefits in Global Supply Chains

IoT empowers supply chain managers to make **faster, data-informed decisions** across multiple regions and logistics providers. In global import/export scenarios, it enables:

- **Proactive rerouting of delayed shipments,**
- **Dynamic inventory reallocation** based on real-time supply status,
- **Improved coordination** between third-party logistics providers (3PLs), customs authorities, and internal stakeholders.

It also facilitates **compliance monitoring**, helping firms meet regulations such as the EU's General Food Law or the U.S. Drug Supply Chain Security Act (DSCSA), which mandate traceability and integrity in cross-border transport.

Challenges and Considerations

Despite its promise, IoT deployment in SCM also faces hurdles:

- **Cybersecurity threats** linked to interconnected devices,
- **Interoperability issues** between platforms and technologies,
- **Data management complexity** due to the volume and velocity of generated data,
- **Cost barriers**, particularly for SMEs in developing countries.

Nevertheless, as IoT platforms mature and become more affordable, these barriers are gradually diminishing.

Efficient inventory management is vital in import-export supply chains to meet demand without overstocking. **Internet of Things (IoT) technologies** – sensors, RFID tags, and connected devices – are providing unprecedented visibility into inventory across global warehouses and in-transit shipments. IoT devices can track stock levels, item locations, and environmental conditions in real time. This means importers/exporters know exactly where goods are in the pipeline and their condition (e.g. temperature for perishables), enabling proactive reordering or rerouting as needed. Real-time IoT-based tracking of shipments **helps identify delays or disruptions early**, so companies can adjust inventory allocation or find alternate supply routes. IoT “smart shelves” and warehouse sensors also automate

inventory counts and trigger restocking alerts, reducing manual stock checks. These improvements lead to **better inventory accuracy and lower carrying costs**, as companies avoid the classic “just in case” overstocking and can trust data to optimize stock levels.

Crucially, IoT data feeds into **predictive analytics systems** that forecast inventory needs with greater precision. By analyzing IoT-collected data on shipment transit times, seasonal demand patterns, and lead time variability, AI algorithms can forecast when inventory will run low or when spikes in demand will occur. This allows exporters and importers to **proactively adjust inventory** – expediting shipments or holding goods at a port warehouse – to prevent stockouts or gluts. For example, an AI system might predict that a certain critical component from abroad will be delayed by a week (based on real-time logistics data and port congestion news), prompting a manufacturer to redistribute existing stock or source from an alternate supplier to avoid a production halt. These predictive capabilities shrink the bullwhip effect and improve fulfillment rates.

Moreover, IoT devices support **predictive maintenance** of logistics assets (trucks, containers, machinery), which indirectly benefits inventory management. Sensors on vehicles and equipment can detect signs of malfunction and schedule maintenance *before* a breakdown halts the flow of goods. This reduces unexpected downtime that could cause inventory shortages or delivery failures. Overall, studies find that IoT-driven visibility and AI analytics together create a much **leaner, responsive inventory system**, aligning stock with real demand across borders. Companies that have adopted IoT and big-data analytics in their supply chains report lower inventory holding costs and higher order fulfillment rates, thanks to timely insights and data-driven decision-making. In short, IoT and predictive analytics are

key to **optimizing inventory in global trade**, balancing supply and demand while minimizing waste and delay.

1.4 Enhancing Transparency and Traceability in Supply Chains

Lack of transparency in complex international supply chains often leads to delays, mistrust, and compliance risks. Modern tech tools are **lifting the veil on cross-border shipments**, providing end-to-end traceability for all parties. **Blockchain technology** is particularly touted for building trust through immutable, shared ledgers. By recording each handoff of a product (from factory to port to carrier to warehouse) on a blockchain, stakeholders get a *single source of truth* about the product's origin, journey, and status. This transparency not only deters fraud and theft (since any tampering is evident) but also speeds up dispute resolution and compliance checks. A notable example is the *TradeLens* platform (an IBM/Maersk initiative), which used blockchain to provide **end-to-end visibility of shipping containers**. In one case, TradeLens improved traceability for avocado shipments from Africa, assuring all parties of the cold chain integrity and speeding up import clearance. Although TradeLens faced adoption hurdles, it demonstrated the potential of shared data ecosystems in global trade.

IoT also boosts transparency by delivering real-time status updates. **Live tracking** through GPS and cellular-connected devices means shippers and importers can see where their goods are at any moment and monitor conditions (temperature, humidity, tilt) throughout transit. This level of visibility helps expose bottlenecks – for instance, identifying that a container consistently spends 3 days waiting at a certain border crossing – prompting process improvements. It also **builds trust with customers and regulators**: for example, customs can receive IoT data proving a container remained sealed and at acceptable temperature, which can fast-track inspections. The WCO has noted that smart sensors and locks generating real-time

data **strengthen supply chain integrity and transparency** by providing immediate alerts of any unauthorized access or anomalies, thereby reinforcing trust among shippers, carriers, and authorities.

Furthermore, **digital platforms and data standards** are enhancing transparency through better data sharing. Efforts are underway globally to implement *paperless trade* systems where electronic trade documents (in standardized formats) replace paper forms. Such digitization not only speeds up document exchange but also makes it easier to track transactions and detect fraud. According to the Hinrich Foundation, adopting digital trade documents and data standards would significantly **promote transparency in supply chains and transactions**, helping authorities and financial institutions detect anomalies like duplicate invoices or counterfeit certificates. For example, when a bill of lading is electronic and shared, both exporting and importing customs can verify it instantly, catching discrepancies that might indicate smuggling or tax evasion. The end result is a more transparent, secure trading environment where data is readily available to authorized stakeholders. In summary, blockchain's immutable records, IoT's real-time tracking, and digital documentation initiatives collectively create an **unprecedented level of visibility in cross-border supply chains**, fostering trust and collaboration among participants.

Case Study 1: Enhancing Transparency and Efficiency in Cross-Border Trade with Blockchain

1.1. Context: Challenges in Traditional Export/Import Documentation and Traceability

Traditional export and import processes are often encumbered by complex, paper-based documentation, leading to significant inefficiencies. Activities such as verifying bills of lading, certificates of origin, inspection reports, and customs declarations involve manual handling, making them slow, prone to errors, duplication, loss, and vulnerable to fraud. This is particularly acute in international trade, where multiple stakeholders across different jurisdictions (suppliers, manufacturers, logistics providers, customs authorities, buyers) must exchange and validate information. The lack of a single, trusted source of truth can result in delays at borders, increased operational costs, and difficulties in tracing goods, which is critical for regulatory compliance, quality assurance, and combating counterfeit products in global markets.

1.2. The Technology: An Overview of Blockchain in Supply Chains

Blockchain technology, initially known as the foundation for cryptocurrencies, offers a decentralized and immutable digital ledger. This means that transaction records are distributed across a network of computers, making the system resistant to tampering and single points of failure. In the context of supply chains, each event – such as an ownership transfer, a quality check, a customs clearance, or a shipment update – can be recorded as a "block" that is cryptographically linked to the previous one, creating a secure and transparent chain of information accessible to authorized participants (Kshetri, 2018).¹¹

¹¹ **Kshetri, N. (2018).** 1. Blockchain's roles in meeting key supply chain management objectives. *International Journal of Information Management*, 39, 80-89.

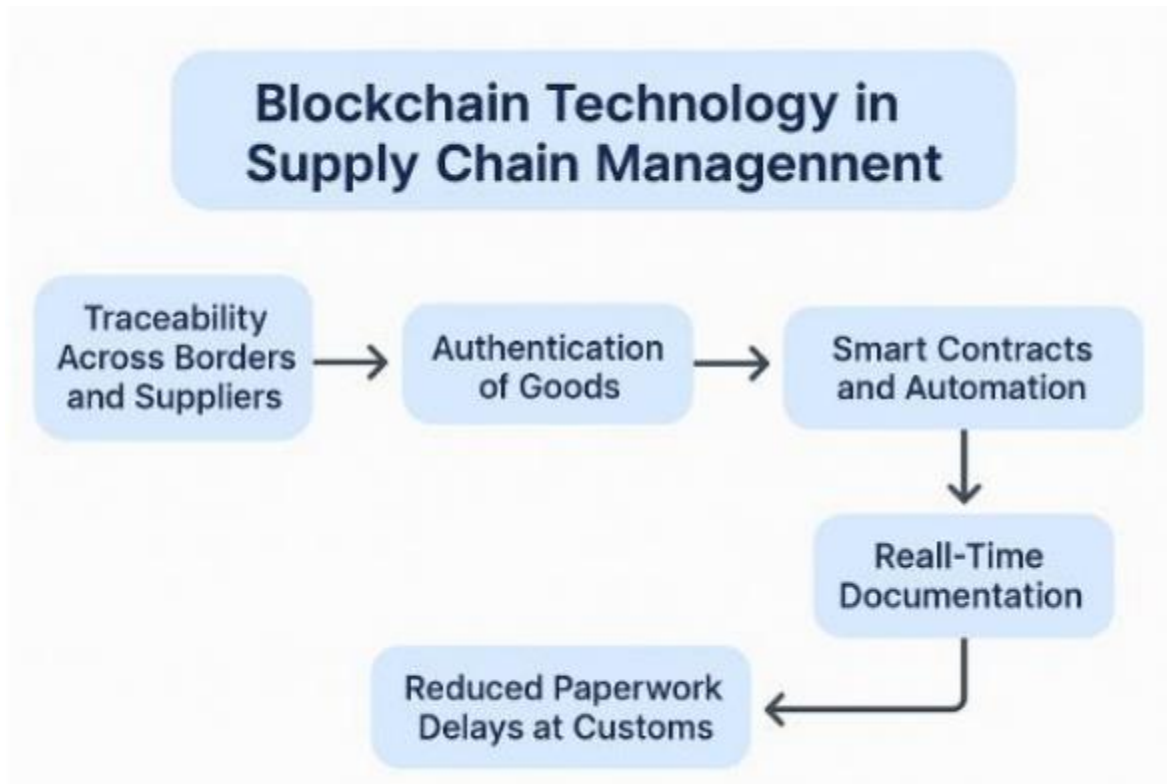


Figure 1: Conceptual Overview of Blockchain Technology in Supply Chain Management (Adapted from source material)

1.3. Application in Export/Import: Streamlining Processes with Blockchain

Blockchain's core attributes directly address many challenges in export/import operations. For international trade, it can facilitate:

- **Enhanced Traceability:** Creating an end-to-end, tamper-proof record of a product's journey across borders, from raw material sourcing to final delivery. This is crucial for verifying authenticity, ensuring compliance with

import/export regulations (e.g., rules of origin), and managing recalls efficiently (Kamath, 2018).¹²

- **Improved Customs Efficiency:** By providing a shared, trusted ledger for trade documents (e.g., digital bills of lading, certificates of origin), blockchain can significantly reduce the time and paperwork involved in customs clearance. Smart contracts, which are self-executing contracts with the terms of the agreement directly written into code, can automate processes like releasing goods upon customs approval or triggering payments once delivery is confirmed.
- **Anti-Counterfeiting:** Assigning unique digital identities to products on a blockchain allows stakeholders (including customs officials and consumers) to verify authenticity at various points in the supply chain, thereby combating the illicit trade of counterfeit goods that plagues many export/import sectors.
- **Automated Payment Execution:** Smart contracts can automate payments in international trade finance. For instance, payment to an exporter can be automatically released once the blockchain records confirmation of goods received by the importer or cleared by customs, reducing reliance on intermediaries and speeding up cash flow.

1.4. Illustrative Examples and Benefits for International Trade

Several initiatives showcase blockchain's potential in export/import. For example, platforms like TradeLens (developed by Maersk and IBM) and we.trade aim to digitize global trade documentation and processes using blockchain. Benefits observed or anticipated include:

¹² **Kamath, R. (2018).** Food traceability on blockchain: Walmart's pork and mango pilots with IBM. *The Journal of the British Blockchain Association*, 1(1), 1-12.

- **Reduced Delays:** Walmart's use of IBM Food Trust for tracing mangoes reportedly reduced traceability time from seven days to 2.2 seconds (Kamath, 2018). Similar speed gains can be expected in customs processing when documents are digitized and shared securely on a blockchain.
- **Lower Costs:** Automation of documentation and payment processes reduces administrative overhead, fees for intermediaries, and costs associated with errors or fraud.
- **Increased Trust and Transparency:** All parties in an export/import transaction have access to the same, verified information, fostering greater trust and collaboration. This is particularly valuable in complex multi-tier global supply chains.
- **Enhanced Security:** Cryptographic security and the distributed nature of blockchain make it difficult for unauthorized parties to alter trade data, protecting against fraud and cyber-attacks.

In the pharmaceutical sector, blockchain is being piloted for compliance with regulations like the Drug Supply Chain Security Act (DSCSA) in the U.S., authenticating drug provenance in international shipments and preventing counterfeit medicines from entering the supply chain (Francisco & Swanson, 2018).¹³

1.5. Limitations and Considerations in Global Blockchain Adoption

Despite its promise, the widespread adoption of blockchain in export/import faces hurdles:

¹³ **Francisco, K., & Swanson, D. (2018).** The LSupply Chain Has No Clothes: Technology Adoption of Blockchain for Supply Chain Transparency. *Logistics*, 2(1), 2.

- **Interoperability:** Different blockchain platforms and legacy systems need to be able to communicate, which is a significant technical challenge.
- **Scalability:** Some blockchain networks can face limitations in transaction processing speed as the number of users and transactions grows.
- **Regulatory Uncertainty:** The legal status of blockchain-based documents and smart contracts varies across jurisdictions, creating uncertainty for international trade.
- **Cost of Implementation:** Initial investment in technology and process re-engineering can be substantial.
- **Data Governance and Privacy:** While transparency is a benefit, managing sensitive commercial data on a shared ledger requires robust governance models and privacy-preserving techniques.
- **Dependency on Oracles:** Smart contracts often rely on external data sources ("oracles") to trigger actions (e.g., GPS data for delivery confirmation). The reliability and security of these oracles are crucial.

Case Study 2: Real-Time Management of International Shipments using the Internet of Things (IoT)

Transportation and Logistics

1. “Importing is the purchase of goods and services from foreign suppliers; exporting is the sale of domestic goods and services to foreign buyers—both regulated by international trade laws.”¹⁴

¹⁴ International Trade: Theory and Policy, Paul R. Krugman, Maurice Obstfeld & Marc J. Melitz, 11th ed., 2018.

2. “The detailed procedures, documentation, tariffs, and regulations required to move products across international borders for sale or use.”¹⁵

3. “The set of commercial transactions in which goods are shipped from one country to another—either purchased abroad (imports) or sold abroad (exports).”¹⁶

4. “Cross-border trading activities governed by customs laws, trade agreements, and finance instruments that underpin global commerce.”¹⁷

5. “The practical process of taking goods to overseas markets and bringing foreign goods into domestic markets, including market research, compliance, and logistics.”¹⁸

This function moves products across the supply chain and includes **freight forwarding, customs brokerage, shipping lines, air cargo, rail transport, and last-mile delivery**. Multimodal logistics (e.g., sea + rail + truck) is increasingly used to optimize cost and time. Companies often use **third-party logistics (3PL)** providers to manage complexity. Customs procedures and trade compliance play a significant role in cross-border logistics (Rushton et al., 2022).

¹⁵ Export/Import Procedures and Documentation, Thomas E. Johnson & Donna L. Bade, 8th ed., 2018.

¹⁶ International Logistics: The Management of International Trade Operations, Alan Rushton, Phil Croucher & Peter Baker, 4th ed., 2017.

¹⁷ International Economics, Robert C. Feenstra & Alan M. Taylor, 4th ed., 2017.

¹⁸ Import/Export: How to Take Your Business Across Borders, Laurel J. Delaney, 4th ed., 2017.

Retailers and Distributors

These intermediaries make the products accessible to end customers. **Distributors** often handle bulk distribution to regional markets, while **retailers** sell directly to consumers either via physical stores or e-commerce platforms. They are crucial for demand generation and inventory clearance. A responsive supply chain relies on real-time data from retailers to drive production and restocking (Mentzer et al., 2001).

Customers (Downstream Users) Q

Customers are the final recipients of products and their **buying behavior drives the upstream flow of goods and information**. In a **demand-driven (pull-based)** system, customer preferences, seasonal trends, and market dynamics directly influence procurement and production. Customer feedback also supports continuous improvement in quality and delivery performance.

Supporting Functions

These cross-functional systems ensure the chain operates smoothly and include:

- **ERP Systems** (e.g., SAP, Oracle) for integrated planning
- **Finance & payment processing**
- **Risk management tools** to identify and mitigate disruptions
- **Regulatory compliance systems** (e.g., customs declarations, trade compliance audits)

These layers are often the first to be digitized through AI, blockchain, and

analytics platforms to enable **real-time visibility**, **predictive maintenance**, and **sustainability tracking** (Gali, 2025).

2.1. Context: The Imperative for Visibility in Global Logistics

Managing international shipments involves navigating vast distances, multiple modes of transport, and various handover points. Lack of real-time visibility into the location, status, and condition of goods in transit is a major pain point for exporters and importers. This opacity can lead to uncertainty in delivery times, difficulty in managing exceptions (e.g., delays, damage, theft), increased buffer stocks, and compromised product integrity, especially for sensitive goods like perishables or pharmaceuticals that require specific environmental conditions during their international journey.

2.2. The Technology: An Overview of IoT in Supply Chain Management

The Internet of Things (IoT) refers to a network of physical objects ("things") embedded with sensors, software, and connectivity, enabling them to collect and exchange data. In SCM, IoT devices can be attached to containers, pallets, individual packages, or vehicles, providing a continuous stream of data about their environment and movement. This data can be transmitted to cloud platforms for analysis and action, transforming logistics from a reactive to a proactive and predictive discipline.

2.3. Application in Export/Import: IoT for Enhanced Shipment Integrity

For export and import operations, IoT offers several critical applications:

- **Live Geolocation Tracking:** GPS-enabled IoT sensors allow continuous monitoring of shipments across international borders, providing accurate Estimated Times of Arrival (ETAs) and early detection of deviations, potential theft, or unauthorized stops. This is vital for coordinating customs clearance and downstream logistics.
- **Environmental Condition Monitoring:** Sensors can track temperature, humidity, shock, light exposure, and other parameters crucial for goods like pharmaceuticals, fresh produce, or sensitive electronics during international transit. Alerts can be triggered if conditions deviate from pre-set thresholds, allowing for timely intervention to prevent spoilage or damage.
- **Enhanced Security:** IoT devices can detect unauthorized access to containers (e.g., door opening sensors) or tampering, providing alerts to security personnel and improving the security of high-value international shipments.
- **Predictive Maintenance for Logistics Assets:** IoT sensors on trucks, ships, or refrigerated containers can monitor operational parameters, enabling predictive maintenance to prevent breakdowns that could disrupt international supply chains and delay deliveries.

2.4. Illustrative Examples and Benefits for Cross-Border Shipments

Global logistics companies like Maersk, DHL, and UPS extensively use IoT for managing international freight. For instance, Maersk's Remote Container Management (RCM) system uses IoT to monitor the location and atmospheric conditions of tens of thousands of refrigerated containers worldwide.

The benefits for export/import activities include:

- **Improved Product Quality and Reduced Spoilage:** Particularly for cold chain logistics in food and pharmaceutical exports/imports, IoT ensures that temperature-sensitive products are maintained within required ranges, reducing losses.
- **Enhanced Supply Chain Responsiveness:** Real-time data allows exporters and importers to react quickly to disruptions, reroute shipments, or inform customers of delays.
- **Better Compliance:** IoT data provides an auditable record of shipment conditions, helping companies comply with international safety, health, and handling regulations (e.g., FDA, EU food safety standards).
- **Optimized Inventory Management:** Accurate ETAs and visibility into goods in transit allow for better inventory planning and reduced safety stock for imported materials or finished goods for export.

2.5. Limitations and Considerations for IoT in International Logistics

Challenges in deploying IoT for global export/import include:

- **Connectivity:** Ensuring consistent sensor connectivity across different geographies and during transit (e.g., on high seas) can be difficult and costly.
- **Data Overload and Management:** The sheer volume of data generated by IoT devices requires robust analytics capabilities and data management strategies.
- **Cybersecurity:** IoT devices can be vulnerable to cyber threats, potentially compromising sensitive shipment data or even allowing malicious actors to interfere with logistics operations.

- **Interoperability and Standardization:** Lack of universal standards for IoT devices and platforms can hinder seamless data exchange between different partners in an international supply chain.
- **Cost:** The initial investment in sensors, connectivity, platforms, and analytics can be a barrier, especially for smaller export/import businesses.
- **Battery Life of Sensors:** For long international voyages, ensuring sensor battery life is sufficient can be a practical challenge.

Case Study 3: Optimizing Global Trade Operations and Compliance via ERP/SCM Systems

3.1. Context: Managing Complexity in Global Trade Operations

Exporting and importing goods involve a multitude of interconnected processes, including procurement from international suppliers, managing multi-currency transactions, adhering to diverse customs regulations and tax regimes, coordinating international logistics, and ensuring compliance with trade agreements. Managing these complexities efficiently is a significant challenge. Siloed information systems and manual processes can lead to errors, delays, non-compliance penalties, and an inability to get a holistic view of international operations, hindering strategic decision-making for businesses involved in global trade.

3.2. The Technology: ERP and SCM Software as an Integrated Backbone

Enterprise Resource Planning (ERP) systems (e.g., SAP S/4HANA, Oracle NetSuite, Microsoft Dynamics 365) and specialized Supply Chain Management (SCM) software provide integrated platforms to manage and automate core business processes. For global trade, these systems offer modules and functionalities

specifically designed to handle international complexities by centralizing data and streamlining workflows across procurement, production, logistics, finance, and compliance (Gupta & Kohli, 2006).¹⁹

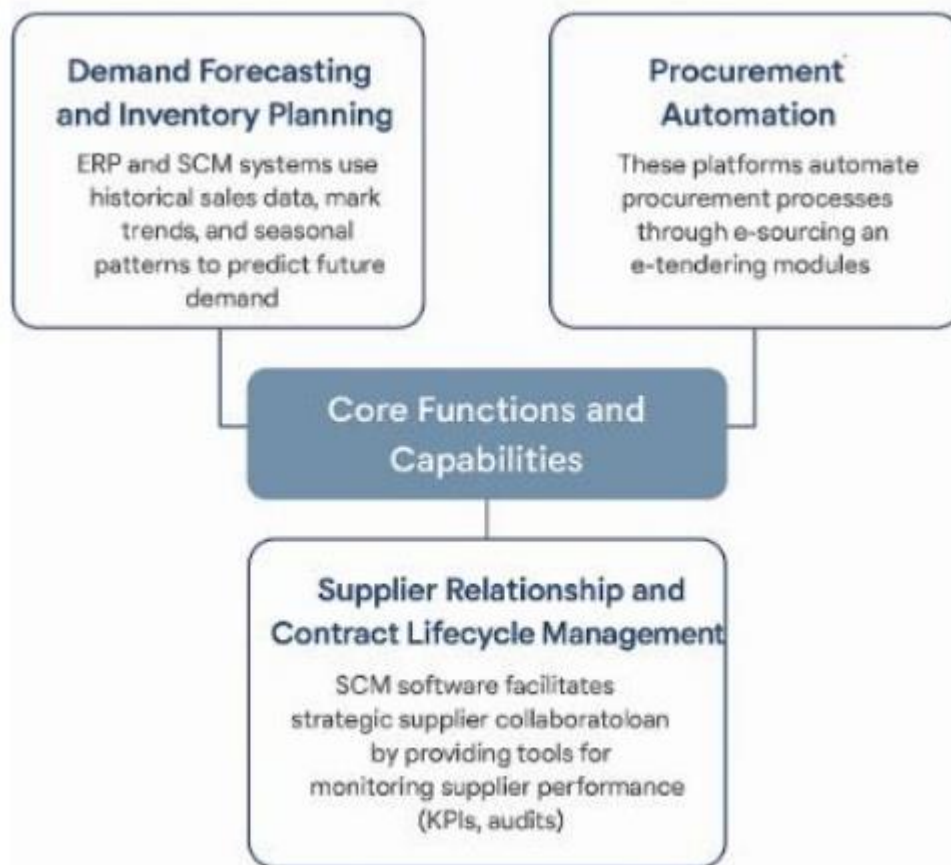


Figure 2:

Core Functional Capabilities of ERP and SCM Systems (Adapted from source material)

¹⁹ Gupta, M., & Kohli, A. (2006). Enterprise resource planning systems and its implications for operations management. *International Journal of Operations & Production Management*, 26(6), 689-711.

3.3. Application in Export/Import: ERP/SCM for International Trade Facilitation

Modern ERP/SCM systems are crucial for export/import businesses by providing:

- **Global Financial Management:** Support for multiple currencies, automated exchange rate conversions, and consolidation of financial statements from international subsidiaries. This simplifies accounting for import costs and export revenues.
- **International Procurement and Sourcing:** Tools for managing global supplier relationships, automating purchase orders for imported materials, tracking international shipments, and managing landed costs (including duties, taxes, freight).
- **Customs and Trade Compliance Management:** Specialized modules (e.g., SAP Global Trade Services (GTS), Oracle Global Trade Management (GTM)) help automate compliance checks, generate required export/import documentation, manage licenses, screen against denied party lists, and classify products according to international tariff codes (Stefanou, 2001).²⁰
- **Demand and Supply Planning for Global Markets:** Forecasting demand in various export markets and planning supply of imported components, considering international lead times, transit complexities, and regional inventory requirements.
- **Multi-Language and Localization Support:** Interfaces and documentation in multiple languages, and configurations that adapt to local business practices

²⁰ Stefanou, C. J. (2001). A framework for the ex-ante evaluation of ERP software. *European Journal of Information Systems*, 10(4), 204-215.

and regulatory requirements in different export markets or sourcing countries (Bradford, 2015).²¹

3.4. Illustrative Examples and Benefits for Global Businesses

Many multinational corporations rely heavily on ERP/SCM systems to manage their global export/import footprint. For example, a global electronics manufacturer might use its ERP system to:

- Source components from various Asian countries, managing purchase orders in different currencies and tracking inbound shipments.
- Ensure imported components comply with regulations like RoHS or REACH.
- Manage assembly in one country and then export finished goods to markets in Europe and North America, generating appropriate customs declarations and commercial invoices for each region.
- Consolidate sales and financial data globally for reporting and analysis.

Key benefits include:

- **Improved Operational Efficiency:** Automation of routine export/import tasks reduces manual effort and processing times.
- **Enhanced Compliance:** Reduced risk of penalties from customs or trade authorities due to automated checks and accurate documentation.
- **Better Visibility and Control:** Centralized data provides a comprehensive view of global operations, enabling better decision-making regarding sourcing, inventory, and market strategies.

²¹ **Bradford, M. (2015).** *Modern ERP: Select, implement, and use today's advanced business systems.* Lulu.com.

- **Reduced Costs:** Optimization of procurement, logistics, and inventory, along with fewer compliance-related fines, contributes to lower overall costs for international trade.

3.5. Limitations and Considerations for Global ERP/SCM Deployment

Despite their advantages, implementing and using ERP/SCM systems for global trade has challenges:

- **Complexity and Cost of Implementation:** Global ERP rollouts are often lengthy, complex, and expensive projects requiring significant organizational change.
- **Customization vs. Standardization:** Balancing the need for standardized global processes with local operational and regulatory requirements can be difficult. Over-customization can increase costs and complexity.
- **Data Integration:** Integrating the ERP/SCM system with legacy systems or external partner systems (e.g., those of 3PLs or customs brokers) can be challenging.
- **User Adoption and Training:** Ensuring that staff across different countries and functions are adequately trained and effectively use the system is crucial for realizing benefits.
- **Keeping Up with Regulatory Changes:** While ERP vendors provide updates, businesses are ultimately responsible for ensuring their system configurations reflect the latest trade regulations in all jurisdictions they operate in.

Case Study 4: AI-Driven Demand Forecasting and Inventory Management for Import/Export Businesses

4.1. Context: Navigating Demand and Supply Volatility in International Markets

Businesses engaged in export and import face significant challenges in forecasting demand across diverse international markets and managing inventory subject to long and variable lead times, geopolitical risks, and supply disruptions. Traditional forecasting methods often fall short in accurately predicting demand in volatile export markets or planning for the timely arrival of imported goods. This can lead to stockouts, lost sales, or excess inventory, tying up capital and increasing obsolescence risk, particularly for products with short life cycles or those subject to fluctuating international commodity prices.

4.2. The Technology: AI and Big Data in Supply Chain Decision-Making

Artificial Intelligence (AI), particularly machine learning (ML), and Big Data analytics are transforming supply chain management by enabling more accurate predictions and optimized decisions. AI algorithms can analyze vast and diverse datasets – including historical sales, market trends, economic indicators, social media sentiment, weather patterns, shipping data, and geopolitical risk assessments – to identify patterns and forecast future outcomes with greater precision than

traditional methods (Carbonneau, Laframboise, & Vahidov, 2008²²; Choi, Wallace, & Wang, 2018).²³

4.3. Application in Export/Import: Predictive Analytics for Global Trade

For import/export businesses, AI and Big Data offer powerful applications:

- **Enhanced Demand Forecasting for Export Markets:** AI models can analyze unique drivers of demand in different countries (e.g., local holidays, economic conditions, competitor activities in export markets) to produce more granular and accurate sales forecasts. This helps businesses align production and inventory with anticipated export sales.
- **Optimized Inventory for Global Supply Chains:** AI can determine optimal inventory levels for imported raw materials or components and finished goods destined for export, considering factors like international transit times, supplier reliability, port congestion risks, demand volatility in export markets, and the cost of capital (Ivanov & Dolgui, 2020).²⁴ This includes recommending "just-in-case" buffers for critical imported items.
- **Predictive Risk Management for International Shipments:** AI can analyze data to predict potential disruptions in international logistics (e.g., shipping delays due to weather, port strikes, or geopolitical events), allowing businesses to proactively adjust import/export plans.

²² Carbonneau, R., Laframboise, K., & Vahidov, R. (2008). Application of machine learning techniques for supply chain demand forecasting. *European Journal of Operational Research*, 184(3), 1140-1154.

²³ Choi, T. M., Wallace, S. W., & Wang, Y. (2018). Big data analytics in operations management. *Production and Operations Management*, 27(10), 1868-1883.

²⁴ Ivanov, D., & Dolgui, A. (2020). A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0. *Production Planning & Control*, 32(9), 775-788.

- **Dynamic Pricing for Export Products:** AI can help set optimal prices for export markets by analyzing local demand elasticity, competitor pricing, and currency fluctuations.
- **Supplier Risk Assessment for Imports:** AI can assess the risk profile of international suppliers based on financial stability, performance history, and exposure to geopolitical or environmental risks, aiding in more resilient sourcing of imported goods.

4.4. Illustrative Examples and Benefits for Import/Export Inventory

Companies like Amazon and Zara utilize sophisticated AI for demand forecasting and inventory placement across their global networks, which heavily involve import and export operations. For instance, an apparel exporter might use AI to:

- Forecast demand for specific clothing lines in various international markets, considering local fashion trends gleaned from social media and past sales.
- Optimize the quantity of fabric to import based on these forecasts and the reliability of international textile suppliers.
- Determine where to strategically position inventory in regional distribution hubs to quickly fulfill export orders.

Key benefits include:

- **Reduced Stockouts and Lost Export Sales:** More accurate forecasting leads to better product availability in target export markets.

- **Lower Inventory Holding Costs:** Optimized inventory levels for both imported materials and export-ready goods reduce warehousing costs and capital tied up.
- **Improved Responsiveness to Market Changes:** AI enables quicker adaptation to shifts in international demand or disruptions in the supply of imported goods.
- **Enhanced Profitability:** Through better sales, lower costs, and optimized pricing in export markets.

4.5. Limitations and Considerations for AI in Global SCM

Challenges to implementing AI for import/export focused SCM include:

- **Data Quality and Availability:** AI models require large volumes of high-quality data. In global SCM, data can be fragmented, inconsistent, or unavailable, especially from certain international partners or emerging markets.
- **Complexity of Models ("Black Box" Problem):** Some advanced AI models can be difficult to interpret, making it challenging to understand the reasoning behind their forecasts or recommendations, which can be an issue for accountability in international trade decisions.
- **Talent Gap:** Expertise in data science, AI, and SCM is required to develop, implement, and manage these systems effectively.
- **Integration with Existing Systems:** Integrating AI platforms with legacy ERP or SCM systems used for managing import/export operations can be complex.
- **Cost of Technology and Expertise:** AI solutions and the talent to run them can be expensive, posing a barrier for smaller import/export enterprises.

- **Dynamic Global Environment:** Unprecedented global events (like pandemics or sudden geopolitical shifts) can still challenge AI models trained on historical data, requiring human oversight and model recalibration.

Case Study 5: Strategic Application of Leagile and JIT Principles in an International Export/Import Setting

5.1. Context: Balancing Efficiency and Responsiveness in Global Supply Chains

Companies involved in international trade constantly strive to balance cost efficiency with the ability to respond quickly to fluctuating global demand and navigate supply chain uncertainties. Purely Lean approaches, focused on waste elimination, can make supply chains vulnerable to disruptions common in export/import (e.g., shipping delays, customs hold-ups). Purely Agile approaches, focused on responsiveness, might incur higher costs. This dilemma is particularly acute for businesses sourcing components globally (imports) and serving diverse export markets with varying customer preferences.

5.2. The Principles: Leagile and Just-in-Time (JIT) Paradigms

Just-in-Time (JIT) is a production and inventory strategy aiming to receive goods only as they are needed in the production process or by customers, thereby minimizing inventory holding costs. It relies on highly coordinated and reliable supply, which can be challenging in global contexts (Schonberger, 1982).²⁵

²⁵ Schonberger, R. J. (1982). *Japanese manufacturing techniques: Nine hidden lessons in simplicity*. Free Press.

Leagile is a hybrid strategy that combines Lean principles (efficiency, cost reduction) in the upstream, forecast-driven parts of the supply chain, and Agile principles (responsiveness, flexibility) in the downstream, demand-driven parts. A key element is the "decoupling point," where the switch from a push (Lean) to a pull (Agile) strategy occurs, often involving postponement of final product configuration until actual customer orders from export markets are received (Naylor, Naim, & Berry, 1999²⁶; Christopher & Towill, 2001).²⁷

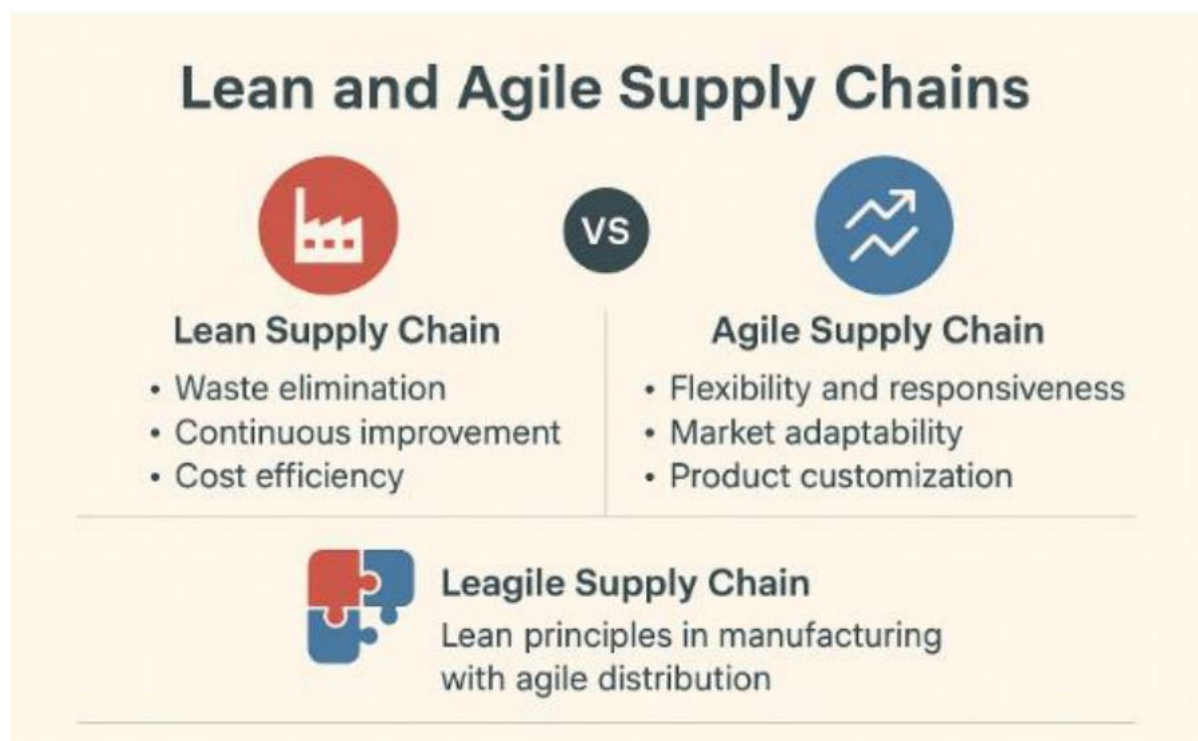
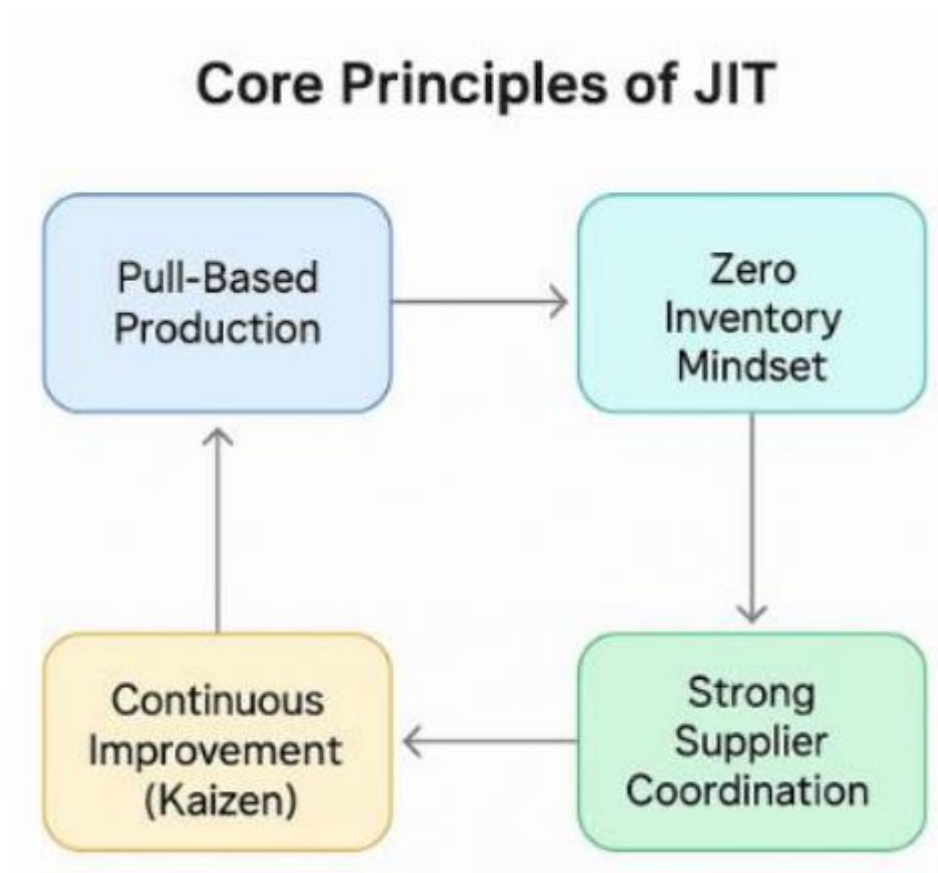


Figure 3: Comparison of Lean, Agile, and Leagile Supply Chains (Adapted from

²⁶ Naylor, J. B., Naim, M. M., & Berry, D. (1999). Leagality: integrating the lean and agile manufacturing paradigms in the total supply chain. *International Journal of Production Economics*, 62(1-2), 107-118.

²⁷ Christopher, M., & Towill, D. (2001). An integrated model for the design of agile supply chains. *International Journal of Physical Distribution & Logistics Management*, 31(4), 235-246.



source material)

Figure 4: Core Principles of JIT (Adapted from Schonberger, 1982, as presented in source material)

5.3. Application in Export/Import: Adapting Leagile/JIT for International Trade

JIT in Import/Export:

- For importing components, JIT requires extremely reliable international suppliers and logistics providers. Nearshoring or regional sourcing can sometimes support JIT by reducing transit times and uncertainty.
- For exporting finished goods, JIT can be challenging due to unpredictable shipping schedules and customs clearance times. However, JIT principles can

be applied to final assembly or packaging stages once imported components are securely onshore and export orders are confirmed.

Leagile in Import/Export (often more practical):

- **Upstream (Lean):** Companies might mass-produce or procure standardized base products or components (potentially imported in bulk to achieve economies of scale) based on aggregate forecasts.
- **Decoupling Point:** This could be a regional distribution center or a final assembly plant near key export markets.
- **Downstream (Agile):** Final customization (e.g., language-specific packaging, software installation for a particular export market, adding region-specific accessories) is performed at or after the decoupling point, based on actual export orders. This is a classic postponement strategy (Yang, Burns, & Backhouse, 2004).²⁸

5.4. Illustrative Examples and Benefits in Global Operations

Consider a global electronics company:

- It might import standard microchips and circuit boards (Lean upstream) in large volumes to central manufacturing hubs.
- The base devices are assembled. The decoupling point occurs before final software loading and packaging.

²⁸ **Yang, B., Burns, N. D., & Backhouse, C. J. (2004).** Postponement: a review and an integrated framework. *International Journal of Operations & Production Management*, 24(5), 468-487.

- When an order comes from an export market (e.g., Germany), the device receives German-language software, a German power adapter, and German packaging (Agile downstream).

Benefits of Leagile in export/import:

- **Reduced Inventory Risk:** Holding generic inventory upstream is less risky than holding finished goods specific to multiple export markets, which might not sell.
- **Increased Customization for Export Markets:** Ability to tailor products to specific international customer needs without excessive inventory.
- **Improved Responsiveness:** Faster fulfillment of specific export orders once the generic components are in place.
- **Cost Efficiency:** Economies of scale in producing/importing standardized upstream components.



Figure 5: Benefits of

Just-in-Time (JIT) in Global Supply Chains (Adapted from source material)

5.5. Limitations and Challenges for Leagile/JIT in Export/Import

Challenges for JIT in International Contexts (Sheffi, 2015²⁹; Christopher, 2016):³⁰

- **Vulnerability to Disruptions:** JIT systems with minimal buffers are highly susceptible to international shipping delays, port congestion, customs issues, natural disasters, or geopolitical events affecting import supply lines.
- **Supplier Reliability:** Heavy reliance on the punctuality and quality of international suppliers, which can be harder to ensure across long distances and different business cultures.

²⁹ Sheffi, Y. (2015). *The power of resilience: How the best companies manage the unexpected*. MIT Press.

³⁰ Christopher, M. (2016). *Logistics & supply chain management*. Pearson UK.

- **Transportation Costs:** Frequent, small shipments often associated with JIT can be more expensive for international freight compared to bulk shipments.

Challenges for Leagile in International Contexts:

- **Complexity of Decoupling Point Management:** Identifying the optimal decoupling point and managing inventory and processes around it in a global network can be complex.
- **Forecasting Accuracy Upstream:** The Lean upstream portion still relies on forecasts, which can be challenging for globally sourced materials.
- **Coordination:** Requires tight coordination between upstream (often international sourcing/manufacturing) and downstream (often regional/export market-focused) operations.

Cross-Case Analysis and Discussion

The preceding case studies highlight several common themes and interdependencies in the application of SCM principles and technologies to export and import activities. A primary overarching theme is the relentless pursuit of **visibility and transparency** across complex international supply chains. Blockchain and IoT directly address this by providing mechanisms for real-time tracking and immutable record-keeping, crucial for everything from customs clearance to ensuring the integrity of goods imported from or exported to distant markets.

Another significant theme is the drive for **efficiency and cost reduction** in inherently costly international operations. ERP/SCM systems provide the backbone for process integration and automation, reducing administrative overhead in

managing multi-currency transactions, global procurement (imports), and export order fulfillment. AI and Big Data further contribute by optimizing inventory (balancing costs of imported goods against export demand) and improving forecast accuracy, minimizing waste from overstocking or lost sales in export markets. Lean strategies, particularly through postponement, aim to achieve economies of scale in upstream (often import-reliant) activities while maintaining flexibility for diverse export market demands.

Compliance and risk mitigation also emerge as critical concerns in export/import, addressed by multiple technologies. Blockchain enhances traceability for regulatory adherence (e.g., food safety for imports/exports, anti-counterfeiting). ERP systems embed global trade compliance rules for customs and tax. AI can help in assessing supplier risk for imports or predicting disruptions in international logistics routes. The inherent vulnerabilities of JIT in long international supply lines underscore the need for robust risk management, potentially through strategic buffering (a "just-in-case" element) or diversification of import sources and export routes.

Synergies between these technologies are evident. For instance, IoT data on shipment location and condition can trigger smart contracts on a blockchain, automating payments or customs declarations. AI can analyze data from ERP systems and IoT sensors to provide more accurate demand forecasts for export markets or optimize routing for international shipments. However, conflicts can also arise. The data-intensive nature of AI and IoT might strain existing ERP infrastructures if not properly integrated. The push for extreme leanness in JIT might conflict with the need for resilience and buffer stocks suggested by AI-driven risk assessments in volatile import/export environments.

Ultimately, businesses engaged in international trade must adopt a holistic approach, strategically combining these technologies and principles. The choice and implementation will depend on the specific industry, the nature of goods being imported/exported, the complexity of the supply network, and the risk appetite of the organization. The overarching implication is that digital transformation is no longer optional but essential for competitiveness and resilience in the global marketplace.

Conclusion

This report has explored, through a series of case studies, the significant impact of modern Supply Chain Management technologies and principles on export and import activities. It is evident that technologies like Blockchain, IoT, ERP/SCM systems, and AI, along with strategic frameworks such as Leagile and JIT, offer powerful tools to address the inherent complexities and challenges of international trade. They contribute to enhanced visibility and traceability across global networks, streamline customs and documentation processes, improve the integrity and security of goods in transit, optimize inventory and forecasting for international markets, and support robust compliance and risk management.

The case studies demonstrate that while each technology or principle offers unique benefits, their true potential is often realized through strategic integration. For businesses engaged in exporting and importing, leveraging these advancements can lead to substantial improvements in operational efficiency, cost reduction, market responsiveness, and overall competitiveness. However, successful adoption requires careful planning, investment, and adaptation to the specific context of global operations, including addressing challenges related to interoperability, data management, regulatory landscapes, and organizational change.

As global trade continues to evolve, driven by geopolitical shifts, changing consumer expectations, and the imperative for sustainability, the role of these SCM innovations will only grow in importance. Future trends will likely see even deeper integration of these technologies, greater use of predictive and prescriptive analytics, and the development of more resilient and adaptive supply chain ecosystems capable of navigating the uncertainties of the international marketplace. For export/import focused enterprises, embracing this technological and strategic evolution is key to thriving in an increasingly interconnected and dynamic world.

Modern technologies and startup-led innovations are playing a transformative role in **unlocking efficiencies in export and import supply chains**. From AI algorithms that fine-tune logistics and inventory, to blockchain systems that build trust and eliminate paper, to IoT devices that render shipments fully visible, these tools collectively drive a more frictionless (“borderless”) trade environment. Real-world cases – whether a digital freight forwarder slashing costs, or a blockchain platform speeding up customs in Africa – demonstrate tangible improvements: faster transit times, lower costs, greater transparency, and better risk management. Importantly, the **global trends** point to deeper integration of such technologies, though not without challenges regarding standardization, inclusivity, and security. For policymakers, businesses, and innovators, the imperative is to collaborate in scaling these solutions and addressing the gaps, so that the benefits of digital supply chain transformation can be widely shared. In doing so, the vision of a highly efficient, technology-enabled global trade system – one that truly makes borders seamless in the flow of goods – becomes increasingly attainable.

Chapter 2: Applied literature on study variables

This chapter provides a comprehensive review of the applied literature pertinent to the study variables. It systematically examines existing research, empirical studies, and scholarly contributions that have explored the key constructs central to this thesis. By synthesizing and critically analyzing the current body of knowledge, this chapter aims to identify prevailing trends, debates, and gaps in the literature related to each variable. The insights gleaned from this review will not only contextualize the present study within the broader academic discourse but also serve to inform the development of the research hypotheses and the interpretation of the subsequent findings.

Local previous studies

1. The Use of Technology in Logistics Management and Global Supply Chains – An Analytical and Prospective Study

Author: Belhol, A. M., & Aouzi, F. M.

Publication Date: October 31, 2024

Nature of the Study: Analytical and Prospective Study

The study aims to explore the current state of technology use in logistics management and global supply chains, analyze the challenges faced by developing countries in this field, and predict the future of these technologies.

Research Problem: The study addresses the digital gap between developed and developing countries in utilizing technology in supply chains and seeks ways to bridge this gap and implement digital tools for integration and sustainability.

The study relies on a theoretical and comparative analysis of international experiences. Relying on descriptive-analytical approach, using foresight and comparative analysis tools.

This study concluded that technology plays a vital role in improving the efficiency of supply chains. Developing countries need to enhance digital infrastructure, technical skills, and international collaboration to close the technological gap.

Keywords: Technology, logistics, supply chains, sustainability, digital transformation, developing countries, Algeria.³¹

2. The Importance of Information Technology in Improving Algeria's Trade Sector: A Case Study of Supported Goods Supply Chains

Author: Boussaib, I., & Ben Ali, A. M.

Publication Date: November 27, 2024

Nature of the Study: Scientific Paper presented at a National Conference

The study focuses on the role of information technology in improving Algeria's trade sector, especially through the digital management of supply chains for supported goods.

The study explores how information technology can improve the efficiency of supported goods supply chains in Algeria. It does not use a field sample but is based on theoretical analysis. This study relied on descriptive-analytical approach.

³¹ Belhol, A. M., & Aouzi, F. M. (2024). The use of technology in logistics management and global supply chains – An analytical and prospective study. University of El-Oued. Retrieved from <https://dspace.univ-eloued.dz/items/6b020fe0-b9e3-4f31-9702-ff77a4fbb9a3>

The study concluded that digital transformation is essential for enhancing the trade sector in Algeria, particularly in supported goods supply chains, by utilizing technologies like the Internet of Things (IoT) and artificial intelligence.

Keywords: Information technology, digital transformation, supply chains, supported goods, Algeria. ³²

3. The Role of Export Strategy in Enhancing the Competitiveness of Algerian Agricultural Products from 2000-2020

Author: Kasmi, A., & Kawahla, B.

Publication Date: 2022

Nature of the Study: Master's Thesis – 8 May 1945 University of Guelma

The objective was to examine the role of the export strategy in boosting the competitiveness of Algerian agricultural products in international markets, with a focus on the 2000-2020 period.

The study investigates how export strategies contribute to enhancing the competitiveness of Algerian agricultural products, especially through digital tools.

This study uses a theoretical and inductive analysis with descriptive-analytical approach.

³² Boussaib, I., & Ben Ali, A. M. (2024). The importance of information technology in improving Algeria's trade sector: A case study of supported goods supply chains. University of El-Oued. Retrieved from <https://dspace.univ-eloued.dz/items/4e693b62-ea67-4217-b71c-a332aaba2d31>

The study highlighted that the digitization of exports and modernization of procedures significantly contribute to improving the competitiveness of Algerian agricultural products in global markets.

Keywords: Export strategy, competitiveness, digitization, agricultural products, Algeria.³³

4. The Role of E-commerce in Promoting Exports Outside the Hydrocarbon Sector in Algeria: Case Study of Renault Agency, Guelma

Author: Swaissid, S., & Salhi, W.

Publication Date: 2016

Nature of the Study: Master's Thesis – 8 May 1945 University of Guelma

The objective is to explore how e-commerce can enhance Algeria's non-hydrocarbon exports, with a focus on the Renault agency in Guelma.

The study seeks to determine how e-commerce can contribute to promoting Algeria's exports outside the hydrocarbon sector.

The study relied on a case study of the Renault agency in Guelma.

Research Methodology: Descriptive-analytical approach.

³³ Kasmi, A., & Kawahla, B. (2022). The role of export strategy in enhancing the competitiveness of Algerian agricultural products from 2000-2020 (Master's thesis). 8 May 1945 University of Guelma. Retrieved from <https://dspace.univ-guelma.dz/jspui/handle/123456789/12790>

Key Findings: The study found that developing ICT infrastructure and providing suitable legal frameworks are essential for facilitating e-commerce, which in turn can enhance Algeria's non-oil exports.

Keywords: E-commerce, non-hydrocarbon exports, export development, Algeria.³⁴

5. Information Technology and the Increase of Exports in Algeria

Author: Boussaib, I., & Ben Ali, A. M.

Publication Date: Unknown (assumed post-2020)

Nature of the Study: Scientific Article

The study aimed to analyze the role of information technology in boosting Algeria's exports, focusing on the use of tools like e-commerce and digital marketing.

This study was to evaluate how can information technology contribute to increasing Algeria's exports? Theoretical analysis is used, with descriptive-analytical approach.

³⁴ Swaissid, S., & Salhi, W. (2016). The role of e-commerce in promoting exports outside the hydrocarbon sector in Algeria: Case study of Renault agency, Guelma (Master's thesis). 8 May 1945 University of Guelma. Retrieved from <https://dspace.univ-guelma.dz/jspui/handle/123456789/9405>

The study concluded that information technology, including e-commerce and digital marketing, plays a key role in boosting Algeria's exports by improving communication with foreign markets and streamlining export processes.

Keywords: Information technology, exports, e-commerce, digital marketing, Algeria.³⁵

6. Optimising supply chain management in the context of E-commerce in Algeria: Jumia's perspectives and best practices

Author: Dr. Imane TABET DERRAZ

Publication Date: 31/08/2023

Nature of the Study: Scientific Article

According to the annual report of the UN Conference on Trade and Development (UNCTAD), Algeria has risen 29 places in the global e-commerce rankings. This study highlight the development of supply chain management (SCM) within Algerian ecommerce companies, using Jumia as an example. This last effectively implements the three essential SCM flows: physical flows, information flows, and financial flows. To maintain competitiveness, the company relies on technological integration, collaboration with partners, sustainable management, and data analysis. Optimizing stocks, wellorganized warehouses, and data-driven decision-making are among the best SCM practices at Jumia. These approaches aim to maintain its

³⁵ Boussaib, I., & Ben Ali, A. M. (n.d.). Information technology and the increase of exports in Algeria. Retrieved from https://www.researchgate.net/publication/365500203_tknwlwjya_almlwmat_wzyadt_alsadrat_fy_aljzayr

Title	Author & date	Nature of study	objective	Problematic	methodology	Key findings
The Use of Technology in Logistics Management and Global Supply Chains – An Analytical and Prospective Study	Belhol, A. M. & Aouzi, F. M. Oct 31, 2024	Analytical & Prospective Study	Explore current and future technology use in logistics and supply chains	How can developing countries bridge the digital gap in supply chains and implement sustainable digital tools?	Descriptive-analytical, foresight & comparative analysis	Technology improves supply chain efficiency; digital investment crucial for developing nations
The Importance of Information Technology in Improving Algeria's Trade Sector: A Case Study of Supported Goods Supply Chains	Boussaib, I. & Ben Ali, A. M . Nov 27, 2024	Conference Paper	Assess IT's role in trade sector performance	How can IT improve the efficiency of supported goods supply chains in Algeria?	Theoretical, descriptive-analytical	IT tools like AI are essential for digital transformation in trade
The Role of Export Strategy in Enhancing the Competitiveness of Algerian	Kasmi, A. & Kawahla, B 2022.	Master's Thesis	Examine export strategy's role in global competitiveness	How can export strategies and digital tools improve Algerian	Theoretical and inductive, descriptive-analytical	Digitization of modern procedures supports competitiveness

Agricultural Products (2000–2020)				agricultural exports' competitiveness?			
The Role of E-commerce in Promoting Exports Outside the Hydrocarbon Sector in Algeria: Case of Renault Agency, Guelma	Swaissid, S. & Salhi, W. 2016	Master's Thesis	Explore e-commerce's potential in non-oil exports	What is the role of e-commerce in enhancing Algeria's non-hydrocarbon exports?	Case study, descriptive-analytical	ICT infrastructure and reforms are for commerce-based ex growth	
Information Technology and the Increase of Exports in Algeria	Boussaib, I. & Ben Ali, A. M. Post-2020	Scientific Article	Analyze how IT boosts exports	How does IT, including e-commerce and digital marketing, contribute to export growth?	Theoretical, descriptive-analytical	IT facilit better ma communicat and ex process efficiency	
Optimising SCM in the Context of E-commerce in Algeria: Jumia's	Dr. Imane Tabet Derraz	Scientific Article	Analyze SCM development in Algerian e-commerce	How do Algerian e-commerce firms like Jumia use SCM	Descriptive with case-based insights	Integration tech, sustainable practices, analytics	

Perspectives and Best Practices	Aug 31,2023			practices to stay competitive?		strengthen SCM performance
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leadership in the Algerian ecommerce market while enhancing the customer experience. Key Words: E-commerce, SCM, logistics, Jumia, Algeria.³⁶

International previous studies

1- Supply Chain Management & Export-Import Trading

Year: 2024

Source: IJNRD (International Journal of Innovative Research and Development)

The study titled "Supply Chain Management & Export-Import Trading: A Key Aspect" was authored by Shreyans Sinha and Dr. Abhishek Mendiratta, a student and an assistant professor at Amity Business School, respectively. It was published in the April 2024 issue of the International Journal of Novel Research and Development (IJNRD).

³⁶. Imane. TABET DERRAZ(2023). Optimising supply chain management in the context of E-commerce in Algeria: Jumia's perspectives and best practices. Laboratory for Studies and Research in Managerial Economics (LEREMA), Higher School of Management Tlemcen. Algeria. JEL Classification: L81, M21.

Retrieved from <file:///C:/Users/Naeem/Downloads/optimising-supply-chain-management-in-the-context-of-e-commerce-in-algeria-jumia's-perspectives-and-best-practices.pdf>

This study aimed to explore how technological innovations in supply chain management can improve export-import operations. This study got as a problematic, the challenges of international trade disruptions, logistics bottlenecks, and cost inefficiencies.

The study relied on qualitative analysis using case study reviews from small to medium enterprises (SMEs) in global trade. As a result, technologies such as AI and IoT help optimize the logistics process and reduce delays in cross-border trade.³⁷

2- Role of Technologies in Import and Export of Goods

Year: 2024

Source: ResearchOnline (James Cook University)

The study titled Role of Technologies in Import and Export of Goods was authored by Irfan Ul Haq, Scott Douglas McDonald, and Mohammedreza Akbari. It is a chapter in the book “Transforming Logistics in a Developing Nation”, focusing on the impact of technological advancements on logistics and supply chains.

The nature of the study is thematic and analytical, exploring trends and developments in technology's role in global trade. However, it does not appear to involve a specific sample size or participant-based research, as it is more of a conceptual and literature-based analysis.

This study aimed to investigate the role of technologies like blockchain and automation in international goods trading. This study got as a problematic, the complexity of cross-border payments and tracking of goods.

³⁷ Sinha, S., & Mendiratta, A. (2024). Supply chain management & export-import trading: A key aspect. *International Journal of Novel Research and Development*, 11(4), 1–15.

The study relied on Mixed-methods approach, combining qualitative interviews and quantitative survey data.

Throughout the SMEs involved in international trade within the Asia-Pacific region. As a result, blockchain technologies significantly streamline payments and improve traceability in international transactions.³⁸

3- Technological Advancements in Import/Export Operations at Global Ports

Year: 2023

Source: Journal of Shipping and Trade

This study aimed to explore how modern technologies are reshaping operations at global shipping ports and their impact on supply chains.

This study got as problematic, Inefficiency in port operations leading to longer waiting times and cost overruns. The study relied on Quantitative data analysis using port performance metrics before and after adopting new technologies. From Ports in Southeast Asia and Europe. As a result, Ports with automated systems showed a 30% increase in throughput and a significant reduction in vessel waiting times.³⁹

³⁸Ul Haq, I., McDonald, S. D., & Akbari, M. (2024). Role of technologies in import and export of goods. In Transforming logistics in a developing nation (pp. 65–88). ResearchOnline@James Cook University.

³⁹. (2023). Technological advancements in import/export operations at global ports. Journal of Shipping and Trade.

4- Supply Chain Management and Importing: The Role of Technology in Improving Operational Efficiency

Year: 2023

-Source: Export Virginia

This study aimed to assess the impact of modern supply chain technologies on operational efficiency in importing activities. This study got as a problematic, Inefficiencies in managing inventory and sourcing materials globally.

The study relied on Case study approach and survey distribution. Collecting data from 15 multinational corporations involved in importing. As a result of this study, the integration of technologies like RFID and cloud-based systems resulted in faster and more accurate inventory management.⁴⁰

5- Blockchain in Global Supply Chains and Cross Border Trade: A Critical Synthesis

Year: 2019

Source: arXiv

This study aimed to critically review how blockchain can address challenges in cross-border trade and supply chain operations. This study got as problematic, trust issues in transactions, payment delays, and fraud in international trade. The study relied on Literature review and expert interviews. from global supply chain

⁴⁰ . (2023). Supply chain management and importing: The role of technology in improving operational efficiency. Export Virginia.

companies using blockchain solutions. As a result of this study, Blockchain increases transparency, reducing fraud and transaction delays by up to 50%.⁴¹

6- How Does Technology in Import and Export Affect Innovation?

Year: 2020

Source: Wiley Online Library

The main objective of this study is to examine how technology adoption in export/import operations influences innovation in product and process development. This study possesses as a problematic, lack of innovation in processes and product offerings due to outdated technological infrastructure. The study relied on Survey-based research with qualitative data analysis. From 25 firms that recently adopted new technologies in their supply chains. As a result, companies with advanced supply chain technologies were more likely to innovate their products and services.⁴²

7- Revolutionizing Global Logistics: Technology in Import and Export

Year: 2023

Source: IdeiaVeloz Business

This study aimed to explore the role of emerging technologies such as AI, big data, and IoT in transforming logistics operations for imports and exports. This study got as a problematic, inefficient logistics systems lead to high transportation costs.

⁴¹ (2019). Blockchain in global supply chains and cross-border trade: A critical synthesis. arXiv.

⁴² . (2020). How does technology in import and export affect innovation? Wiley Online Library.

The study relied on mixed methods involving case studies and quantitative data from logistics firms. Focusing on logistic firms from North America and Europe. As a result of this study, AI and big data analytics reduced logistics costs by 15% while improving delivery speed.⁴³

8- Meeting the Challenge of Changing Global Trade Patterns

Year: 2024

Source: World Economic Forum

This study aimed to understand the role of technology in responding to evolving global trade patterns and cross-border trade challenges. This study got as a problematic, Global trade disruptions, tariff impositions, and fluctuating trade routes. The study relied on Interviews and expert panel discussions, from international trade experts and technology innovators in global shipping.

As result, AI and predictive analytics provide crucial foresight into market fluctuations, helping businesses adapt more effectively.⁴⁴

9- Supply Chain Woes and Technological Solutions in Global Trade

Year: 2024

Source: Wall Street Journal

⁴³(2023). Revolutionizing global logistics: Technology in import and export. IdeiaVeloz Business.

⁴⁴ (2024). Meeting the challenge of changing global trade patterns. World Economic Forum

This study aimed to analyze the technological solutions that are mitigating disruptions in global supply chains.

This study got a problematic, ongoing disruptions and uncertainties in the global supply chain system. The study relied on Case studies on how companies adopted automation and predictive technology during disruptions.

Focusing on companies in sectors severely affected by disruptions, such as manufacturing and automotive.

As a result, companies that adopted predictive tools and automation recovered 30% faster from supply chain interruptions.⁴⁵

10- Artificial Intelligence in Supply Chain Risk Management and Trade

Year: 2025

Source: Vogue Business

This study aimed to examine the role of AI in reducing risks in supply chains, particularly in cross-border trade.

This study got as a problematic, risk management inefficiencies in managing complex supply chains.

The study relied on Data analytics and AI-powered risk assessment models. From Tech-based risk management systems used in global trade. As a result of this

⁴⁵ (2024). Supply chain woes and technological solutions in global trade. Wall Street Journal.

study, AI systems predicted risks in international shipments and recommended alternatives, reducing delays by 20%.⁴⁶

The relationship between the current study and previous studies

(What does the current study add? What are the similarities and differences between this study and previous studies?)

This chapter explores the relationship between the current study — Unlocking Supply Chain Efficiencies in Export and Import: The Contribution of Modern Technologies / Startup Project on BORDERLESS — and prior academic and practical studies reviewed in the beginning of this. It highlights points of convergence, divergence, and advancement, demonstrating how the present research builds upon and extends existing knowledge on modern technologies in cross-border supply chains.

Alignment with Previous Studies

The current study aligns with prior research in several key areas:

Technological Contribution to Supply Chain Efficiency: Like prior studies by Belhol and Aouzi⁴⁷, and Boussaib and Ben Ali⁴⁸.

⁴⁶⁴⁶ Anonymous. (2025). Artificial intelligence in supply chain risk management and trade. Vogue Business.

⁴⁷ Belhol, A. M., & Aouzi, F. M. (2024). The use of technology in logistics management and global supply chains – An analytical and prospective study. University of El-Oued.

⁴⁸ Boussaib, I., & Ben Ali, A. M. (2024). The importance of information technology in improving Algeria's trade sector: A case study of supported goods supply chains. University of El-Oued.

Focus on Digital Transformation and Trade Facilitation: Similar to international studies by Sinha and Mendiratta⁴⁹, and Ul Haq et al.⁵⁰.

Relevance to Developing Countries: Like studies focusing on Algeria by Kasmi and Kawahla⁵¹, and Swaissid and Salhi⁵².

Distinctions and Advancements

The present study distinguishes itself from previous studies in several meaningful ways:

- **Startup and Platform Focus:** Unlike much of the prior literature, this study highlights the contribution of startup-driven platforms (e.g., Flexport, CargoX, Trella).
- **Integration of Multiple Technologies:** This study examines the synergistic impact of integrating AI, blockchain, IoT, and automation.
- **Emphasis on Cross-Border Trade Modernization:** Unlike earlier national-context studies (e.g., Tabet Derraz on Algeria's e-commerce supply chain⁵³), this study extends analysis to cross-border processes.

⁴⁹Sinha, S., & Mendiratta, A. (2024). Supply chain management & export-import trading: A key aspect. *International Journal of Novel Research and Development*, 11(4), 1–15.

⁵⁰Ul Haq, I., McDonald, S. D., & Akbari, M. (2024). Role of technologies in import and export of goods. In *Transforming logistics in a developing nation* (pp. 65–88). ResearchOnline@James Cook University.

⁵¹ Kasmi, A., & Kawahla, B. (2022). The role of export strategy in enhancing the competitiveness of Algerian agricultural products from 2000-2020 (Master's thesis). 8 May 1945 University of Guelma.

⁵² Swaissid, S., & Salhi, W. (2016). The role of e-commerce in promoting exports outside the hydrocarbon sector in Algeria: Case study of Renault agency, Guelma (Master's thesis). 8 May 1945 University of Guelma.

⁵³ Tabet Derraz, I. (2023). Optimising supply chain management in the context of e-commerce in Algeria: Jumia's perspectives and best practices. Laboratory for Studies and Research in Managerial Economics (LEREMA).

- Contemporary Case Studies: This research draws on very recent data and examples (e.g., blockchain-enabled customs in Egypt, AI in 2025 risk management).

Contribution to Knowledge

The study contributes to supply chain knowledge by:

- Providing a holistic view of how modern technologies collectively enhance export-import logistics.
- Emphasizing startups and private innovation ecosystems as key actors in supply chain transformation.
- Highlighting the importance of integration, standardization, and inclusivity in digital trade modernization.

Addressing Research Gaps

The study responds to gaps such as:

- The lack of empirical insights on startup-led innovations in supply chain technology.
- Limited analysis of multi-technology integration impacts on export-import efficiency.
- Under exploration of technology's role in modernizing trade for developing countries.

Summary Table: The Relationship Between the Current Study and Previous Studies

Aspect	Previous Studies	Current Study
Technological focus	Examined specific technologies (e.g., blockchain, IoT, e-commerce) in isolation or narrow contexts (Belhol & Aouzi ¹ ; Boussaib & Ben Ali ²)	Explores integration of multiple technologies (AI, blockchain, IoT, automation) in a holistic supply chain ecosystem
Context	National or sector-specific (e.g., Algeria's trade, supported goods supply chains) (Kasmi & Kawahla ⁵ ; Swaissid & Salhi ⁶)	Focuses on cross-border / export-import supply chains with a "borderless" perspective
Startup innovation	Little focus on startups or platform-driven innovation	Highlights startup contributions (Flexport, CargoX, Trella) as key drivers of supply chain efficiency
Digital trade facilitation	Acknowledged role of IT in reducing barriers, often theoretically	Analyzes practical cases where tech enables faster, more

	(Sinha & Mendiratta ³ ; Ul Haq et al. ⁴)	transparent customs and border processes
Geographic relevance	Focused mainly on Algeria or regional contexts	Addresses global trends and comparative insights relevant to developing countries and global supply chains
Contribution to knowledge	Identified benefits of technology and challenges in specific cases	Adds integrated, up-to-date analysis of combined technologies and startups' role in achieving supply chain efficiency
Addressing gaps	Limited empirical data on startup role; little integrated multi-technology analysis	Provides empirical insights on startups; focuses on synergistic impact of multi-tech integration in export/import logistics

PART II –STARTUP PROJECT “BORDERLESS”

Chapter 1: Introducing Borderless

Project description:

This startup application designed for creative management of export and import activities between Mauritania and Algeria.

Borderless is a startup application designed to creatively manage and streamline export and import activities between Mauritania and Algeria. Operating with a mixed business model—B2B2C (Business-to-Business-to-Consumer) and B2G (Business-to-Government)—Borderless addresses the inefficiencies in cross-border trade by digitizing documentation, optimizing logistics, and enhancing government oversight through data analytics.

The platform targets SMEs, individual traders, and government agencies involved in import/export operations. With robust features like real-time shipment tracking, smart customs clearance tools, and predictive trade analytics, Borderless seeks to become the premier digital gateway for trans-Saharan trade.

- ✓ Project name: **Borderless**
- ✓ Project logo: see appendix 1
- ✓ Project slogan: **commerce without limits, growth without borders** (emphasizes expansion and opportunities).
- ✓ Business Type: mixed, **B2B2C, B2G model** (combining elements of Business-to-Business-to-Customer, Business-to-Government operations,

involves providing products or services to both, other Businesses, Customer, and Government entities), SaaS (Software as a Service).

- ✓ Focus: Streamlining and digitally managing export-import logistics and **facilitate trade movement** between **Mauritania** and **Algeria**.
- ✓ Revenue Streams:
 - **Monthly/Annual Subscription Plans**
 - **Transaction-Based Fees**
 - **Premium Service Packages** (Customs facilitation, legal, tracking, **Government transactions**)

Key Assumptions

Parameter	Value
Initial Investment	\$100,000 (Seed Capital)
Monthly Subscription	\$100/client/month
Average Transaction Fee	\$10 per transaction
Starting Clients (Year 1)	50
Client Growth	50% annually
Monthly Transactions (Year 1)	500
Transaction Growth	40% annually

Parameter	Value
Annual Expense Growth	15%
Corporate Tax Rate	15%
Break-even Target	End of Year 3
Currencies Used	USD, DZD, MRU, USDT

- Initial Investment: \$100,000 (Seed Capital)
- Monthly Subscription: \$100/client/month
- Average Transaction Fee: \$10 per transaction
- Clients (Year 1 Start): 50, growing 50% annually
- Monthly Transactions: 500 in Year 1, growing 40% annually
- Expenses Growth: 15% annually
- Break-even Point: End of Year 3
- Tax Rate: 15%
- Currency Used: USD, DZD, MRU, USDT

Proposed values

Here are proposed value propositions for your Borderless app, which facilitates creative management of export and import activities between Algeria and Mauritania:

◆ 1. Simplified Cross-Border Trade

Value: Streamlines complex customs, documentation, and regulatory processes.

Benefit: Saves time and reduces errors for SMEs and individual traders in both countries.

- ◆ 2. End-to-End Digital Logistics

Value: Integrates shipping, warehousing, freight tracking, and delivery in one app.

Benefit: Offers full visibility and control over cargo in real time.

- ◆ 3. Localized Market Intelligence

Value: Provides real-time insights on demand, pricing, and trade trends in Algeria and Mauritania.

Benefit: Helps users make informed trading decisions and maximize profits.

- ◆ 4. Verified Supplier & Buyer Network

Value: Connects users with trusted and rated partners across borders.

Benefit: Builds confidence and reduces risk in new business relationships.

- ◆ 5. Smart Trade Assistant

Value: AI-powered assistant for optimizing trade routes, cost comparison, and documentation templates.

Benefit: Reduces friction in decision-making for inexperienced traders.

- ◆ 6. Integrated Payment Solutions

Value: Secure in-app payments in multiple currencies (DZD, MRU, USD).

Benefit: Faster and more reliable transactions across borders.

◆ 7. Multilingual Interface (Arabic, French, English)

Value: User-friendly for traders in Algeria and Mauritania.

Benefit: Improves accessibility and user experience.

◆ 8. Export/Import Compliance Support

Value: Provides up-to-date legal and customs info for both countries.

Benefit: Minimizes the risk of penalties and delays.

◆ 9. Eco-Trade Optimization

Value: Promotes sustainable routes and packaging options.

Benefit: Appeals to eco-conscious businesses and consumers.

◆ 10. Support for Informal Sector Integration

Value: Empowers small and informal traders with tools and formalization pathways.

Benefit: Expands economic inclusion and growth in underserved regions.

Work Team

Actual work team:

1. CEO / Founder – Strategic Vision & Leadership: **Fatimetou zehra cheikh Mohamedhen**
2. COO (Operations & Compliance Lead): **Nourddine Taleb Ahmed**

Supposed work team:

This team should combine tech, trade, logistics, finance, and regional expertise.

 Core Founding Team for long term

1. CEO / Founder – Strategic Vision & Leadership

Role:

- Vision, partnerships, government relations
- Fundraising and strategic decision-making
- Deep understanding of Algeria-Mauritania trade landscape

2. COO (Operations & Compliance Lead)

Profile: Expert in logistics, export-import regulations, and customs

Role:

- Manages trade operations, supply chain integration
- Navigates legal frameworks and compliance in both countries

- Connects with shipping, customs, and regulatory authorities

3. CTO (Chief Technology Officer)

Profile: Senior full-stack developer or platform architect

Role:

- Leads app development (mobile + web), APIs, AI tools
- Oversees data security, cloud infrastructure, UX/UI
- Integrates logistics tracking and payment systems

4. CMO (Marketing & Local Community Lead)

Profile: Bilingual (Arabic/French), strong in digital and community marketing

Role:

- Builds user base in both Algeria and Mauritania
- Develops branding, social media, and local campaigns
- Partners with cooperatives, SMEs, and informal traders

5. CFO (Finance & Payments Expert)

Profile: Finance professional with fintech or cross-border payments experience

Role:

- Designs sustainable pricing and payment systems
- Manages funding, budgets, and investor relations

- Handles currency exchange, financial compliance

✖ Support/Advisory Roles

6. Trade Advisor (Part-time or Advisory)

Profile: Former customs or trade policy official

Role:

- Guides regulatory strategies and public sector relationships
- Keeps the app aligned with regional trade regulations

7. Legal Counsel

Profile: Lawyer with experience in international trade or startup law

Role:

- Drafts contracts, user agreements, compliance documentation

8. Local Ambassadors / Field Agents (Mauritania & Algeria)

Profile: Youth or community leaders with business knowledge

Role:

- Recruit users, train informal traders, give app feedback
- Act as the link between digital platform and rural users

✖ Optional (Scaling Phase)

- Data Analyst – For trade insights, market behavior, pricing optimization

- Customer Support Manager – For user support across time zones
- UX/UI Designer – To refine user experience based on feedback

See appendix 2.

Borderless objectives

1. Facilitate Seamless Cross-Border Trade

- Simplify import/export processes for SMEs and informal traders.
- Provide a digital space for secure and traceable trade.

2. Empower Small and Informal Traders

- Offer digital onboarding and training tools to integrate them into the formal economy.
- Provide access to new regional markets and verified buyers/sellers.

3. Digitalize the Export-Import Supply Chain

- Integrate customs, logistics, payments, and documentation into a single digital platform.
- Enable real-time tracking and transaction transparency.

4. Boost Algeria–Mauritania Economic Cooperation

- Strengthen bilateral trade ties through efficient digital infrastructure.

- Create a shared commercial ecosystem tailored to both countries' realities.

5. Promote Local Products Regionally

- Help producers and artisans in both countries export their goods easily.
- Provide demand forecasting tools and visibility for underrepresented products.

6. Support Sustainable and Ethical Trade

- Encourage eco-friendly packaging, optimized shipping, and fair pricing.
- Highlight women- and youth-led businesses.

7. Ensure Financial Inclusion and Access

- Provide secure in-app payment options in local currencies.
- Enable mobile money, bank transfers, and currency conversion tools.

8. Build a Scalable and Replicable Platform

- Start with Algeria-Mauritania, but design a model that can scale to other West and North African countries.
- Develop partnerships with local and regional trade bodies.

Borderless implementation timeline

implementation timeline for Borderless, broken down by phases over a 12-month period. This assumes we are launching a minimum viable product (MVP) first, then scaling operations in Algeria and Mauritania.

Phase 1: Planning & Research (Month 1–2)

Objectives: Define strategy, validate market, prepare legal groundwork

- Market research (logistics, SME needs, trader interviews)
- Regulatory analysis (customs, export/import law)
- MVP feature planning and UI/UX wireframes
- Build partnerships with logistics & payment providers
- Recruit core team (tech, ops, finance, marketing)

Phase 2: Development of MVP (Month 3–5)

Objectives: Build and test key functionalities

- App backend and frontend development (mobile/web)
- Core features: user registration, trade listings, messaging, tracking
- Set up payment integration (DZD, MRU, mobile money)
- Legal documents: user agreements, compliance policies
- Internal testing and bug fixing

Phase 3: Soft Launch & Pilot (Month 6–7)

Objectives: Test with early users in key regions

- Launch pilot in Nouakchott, Algiers, and Tindouf border area
- Recruit and onboard 50–100 test users (SMEs, traders)
- Field agents support and gather feedback
- Monitor performance, usability, and fix issues

Phase 4: Full Launch (Month 8–9)

Objectives: Public launch in both countries

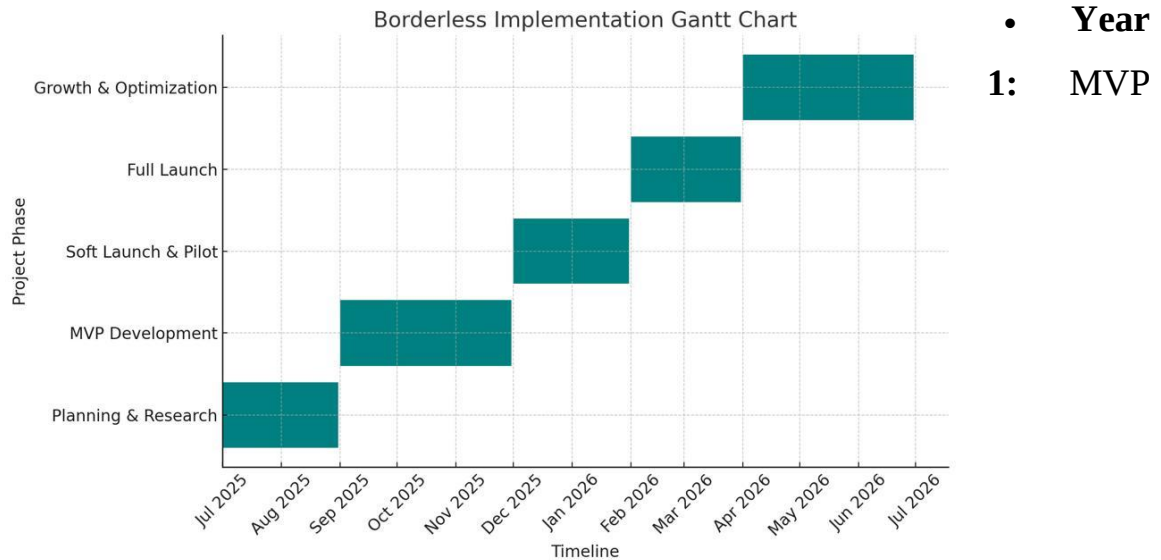
- Public marketing campaign (social, radio, community)
- Partner with trade chambers, cooperatives, and export offices
- Launch help desk and onboarding guides
- Begin generating transactions and traction

Phase 5: Growth & Optimization (Month 10–12)

Objectives: Scale platform and improve features

- Optimize UX/UI based on user behavior
- Launch new features: smart trade assistant, demand alerts, supplier scoring
- Add languages (Hassaniya and Dariga), improve support tools
- Explore expansion to third market (e.g., Mali or Senegal)

Development Roadmap



development, pilot with select exporters/importers.

- **Year 2:** Scale platform, launch in major trade hubs.
- **Year 3-5:** Regional expansion, full government integration.

Source: established by the author

this Gantt chart visualizing the implementation timeline for the Borderless project, broken down into five main phases from July 2025 to June 2026.

Chapter 2: innovative aspects of the project

The nature of Borderless innovation and its impact

This project can be described as a blend of technological, social, and process innovation tailored to the unique trade challenges between Algeria and Mauritania.

Nature of Borderless Innovation

1. Technological Innovation

Borderless uses digital technology to transform outdated and fragmented trade processes:

- Mobile-first platform tailored for low-resource environments
- AI-powered trade assistant to suggest routes, prices, and documents
- Digital logistics tracking integrated with local carriers
- In-app payments with local currencies (DZD, MRU) and mobile money

◆ Impact: Increases transparency, speed, and accessibility in trade.

2. Social Innovation

Borderless fosters inclusive trade, particularly for:

- Informal traders (e.g., women, youth, cooperatives)
- Small-scale producers (e.g., artisans, farmers)
- Underrepresented regions with poor infrastructure

◆ Impact: Provides tools for formalization, market access, and empowerment.

3. Process Innovation

It reinvents how cross-border trade is executed:

- Digitizing documentation (customs, invoices, certificates)
- Simplifying compliance and partner verification
- Creating end-to-end visibility in the supply chain

◆ Impact: Reduces errors, delays, and corruption risks.

4. Business Model Innovation

Borderless introduces new value delivery mechanisms in the regional trade ecosystem:

- Freemium access for SMEs with premium services for exporters
- Commission-based model on successful trades
- Local ambassador system for onboarding and support

◆ Impact: Makes trade services affordable, scalable, and localized.

5. Cultural and Linguistic Innovation

By offering support in Arabic, French, and English, Borderless:

- Breaks down language barriers
- Encourages adoption among non-digital-native communities

◆ Impact: Enhances usability and inclusion.

The innovation field of Borderless

The innovation field of Borderless refers to the specific sector(s) of innovation it operates in and transforms. Borderless sits at the intersection of several critical innovation domains, particularly in Africa's trade and digital economy context.

Innovation Field of Borderless

1. TradeTech (Trade Technology)

Borderless belongs primarily to the TradeTech field — the innovation of trade processes through digital technologies.

◆ Focus:

- Digitizing export/import workflows
- Smart customs documentation
- Cross-border logistics automation

2. Logistics and Supply Chain Innovation

Borderless is transforming logistics and trade routes between Algeria and Mauritania.

◆ Focus:

- Real-time cargo tracking
- Route optimization for inland and border transport
- Coordination between fragmented supply chain actors

3. FinTech (Financial Technology for Trade)

Borderless integrates digital payments and financial inclusion tools for underserved traders.

◆ Focus:

- Multi-currency payments
- Mobile money integration
- Enabling trust and escrow services in transactions

4. Inclusive Innovation / Social Innovation

It targets grassroots, informal, and underserved markets, creating tools for economic inclusion.

◆ Focus:

- Formalizing informal trade
- Onboarding women and youth traders
- Local language access (Arabic, French, English)

5. Platform Economy / Digital Marketplace

Borderless builds a B2B and B2C trade platform tailored to regional realities.

◆ Focus:

- Connecting verified buyers and sellers
- Creating a digital trade ecosystem
- Offering trade-as-a-service for cooperatives and SMEs

6. Regional Integration Innovation

Borderless contributes to economic integration and trade facilitation in North and West Africa.

◆ Focus:

- Enabling the African Continental Free Trade Area (AfCFTA) goals
- Bridging trade gaps between Maghreb and Sahel regions
- Reducing dependency on traditional intermediaries

Borderless is a hybrid innovation operating in:

TradeTech + LogisticsTech + FinTech + Inclusive Innovation + Digital Marketplace

Chapter 3: Legal Study Borderless

1. Overview of Legal Environment

Borderless operates at the intersection of digital commerce and cross-border trade, making it subject to both national and international legal frameworks. The legal study identifies key areas of compliance, regulatory gaps, and potential risks associated with bilateral trade between Algeria and Mauritania.

2. Key Legal Domains Affecting Borderless

a. Trade and Customs Law

Algeria and Mauritania Bilateral Agreements: While both countries are part of the Arab Maghreb Union (AMU), the level of trade facilitation remains limited. There's no fully implemented free trade agreement specific to tech-enabled

platforms.

Customs Regulation Disparities: Each country has different customs codes, documentation requirements, and tariff regimes, which can create compliance issues and clearance delays.⁵⁴

b. E-Commerce Law

Algeria: Law No. 18-05 (2018) regulates e-commerce. It mandates:

- Registration of e-commerce operators
- Consumer data protection
- Prohibition of anonymous sellers

Mauritania: Has limited e-commerce legislation. The sector is lightly regulated, creating ambiguity in consumer protection and online transaction governance.⁵⁵

c. Data Protection and Cybersecurity

Algeria: Law No. 18-07 on personal data protection exists but is inconsistently enforced.

Mauritania: Lacks comprehensive data protection laws, exposing users to privacy risks.

Implication for Borderless: The platform must adopt internal GDPR-style standards for secure data handling and transparent privacy policies.⁵⁶

d. Electronic Transactions and Signatures

⁵⁴ Arab Maghreb Union. (n.d.). About the Union. Retrieved from <http://www.maghrebarabe.org>

⁵⁵ Republic of Algeria. (2018). Law No. 18-05 of May 10, 2018 on E-commerce. Official Journal of Algeria.

⁵⁶ Republic of Algeria. (2018). Law No. 18-07 of June 10, 2018 on the Protection of Individuals in the Processing of Personal Data.

Electronic signature recognition is limited in both countries, which poses legal challenges for online contracts and trade documentation.

e. Financial Regulation

Cross-border payments are regulated by central banks in both countries. Algeria imposes strict currency controls and requires state approval for international transactions, especially in foreign currency.

This creates friction in enabling seamless digital payments or escrow services between Algerian and Mauritanian users.

3. Legal Barriers to Scaling Borderless

Legal Domain	Barrier
Trade law	Lack of harmonization of customs laws
Payment systems	Currency control in Algeria; no regional payment integration
Platform compliance	Mandatory e-commerce registration in Algeria
Consumer protection	Absence of digital dispute resolution systems
Data security	Weak enforcement of data privacy frameworks

4. Risk Assessment and Mitigation

Legal Risk	Mitigation Strategy
Regulatory ambiguity in Mauritania	Collaborate with local trade chambers to establish compliance.
Currency and payment restrictions	Use banking intermediaries, explore blockchain escrow.
Consumer dispute resolution	Integrate in-app legal support and mediation services.
Data protection issues	Adopt EU-standard data protection policies voluntarily.

5. Opportunities for Legal Reform

- Push for cross-border e-commerce facilitation agreements under AMU or African Continental Free Trade Area (AfCFTA).
- Advocate for regional digital payment frameworks.
- Participate in pilot projects with customs to introduce electronic single windows (digital customs portals).⁵⁷

6. Conclusion

The legal landscape in Algeria and Mauritania presents both **barriers and opportunities for Borderless**. While current laws are fragmented or underdeveloped, proactive compliance, legal innovation, and regional advocacy can

⁵⁷ African Union. (2021). African Continental Free Trade Area (AfCFTA). Retrieved from <https://au-afcfta.org>

position **Borderless as a first-mover and a compliance leader in the digital trade space between both countries.**

Chapter 4: strategic market analysis

Market segmentation -Borderless

1. Geographic Segmentation

- Primary Markets:
- DZ Algeria (focus: Tindouf, Bechar, Algiers)
- MR Mauritania (focus: Nouakchott, Nouadhibou, border towns)
- Secondary Targets (Expansion):
- Mali, Senegal, Niger – landlocked trade partners
- North–West Africa corridors under AfCFTA

2. Demographic Segmentation

Segment	Profile description
SMEs & Micro-Enterprises	Traders, agri-processors, cooperatives exporting goods
Informal Traders	Street sellers, local merchants at borders

Youth Entrepreneurs	Startups in local products, e-commerce resellers
Women-led Businesses	Artisans, cooperatives, food product makers
Logistics Operators	Regional transporters, freight forwarders

3. Behavioral Segmentation

Behavior	Borderless response
Price-sensitive users	Free tier access, pay-per-use services
Trust-seeking users	Partner verification, user rating system
Mobile-first digital habits	Mobile-friendly interface, multilingual support
Frustrated with bureaucracy	Smart customs documents, legal/compliance support
Growth-seeking entrepreneurs	Trade insights, market demand forecasts

4. Psychographic segmentation

Traits	Alignment with borderless
Ambitious, under-supported	Offers visibility and formalization tools
Community-driven	Connects local products to regional markets
Tech-curious but cautious	Simple onboarding, human support available
Risk-averse	Transparent pricing, secure in-app payments

5. Market tier breakdown

Market Tier	Description	Examples
Tier 1	Digitally active SMEs & exporters	Date producers in Adrar, cooperatives
Tier 2	Semi-formal traders needing logistics/payment tools	Mauritanian textile traders, grocers
Tier 3	Informal or micro traders needing education	Border hawkers, camel milk traders

Measuring the intensity of competition-Borderless

This analysis uses **Porter's Five Forces** to **evaluate the competitive environment for Borderless**, a digital platform for cross-border trade between Algeria and Mauritania.

1. Threat of New Entrants – Moderate

Entry into digital platforms is technically feasible, but regional logistics partnerships, trust-building, and regulatory complexity are significant barriers.

- Cross-border compliance complexity
- Need for strong on-the-ground networks
- First-mover advantage in Algeria–Mauritania corridor

→ Moderate threat – requires both tech and regional credibility.

2. Bargaining Power of Suppliers – Low

Suppliers include logistics partners, payment gateways, and customs agents. Borderless can negotiate favorable terms due to a fragmented supplier base.

→ Low power – Borderless can switch or aggregate partners.

3. Bargaining Power of Buyers – High

Buyers are SMEs, informal traders, and cooperatives. These users are highly price-sensitive and have many informal alternatives.

→ High power – Borderless must prove reliability, ease of use, and cost savings.

4. Threat of Substitutes – High

Substitutes include informal networks, WhatsApp/Facebook trade groups, and traditional arrangements. These are culturally trusted and often cheaper.

→ High threat – Borderless must build trust and educate users.

5. Industry Rivalry – Low to Moderate

Few structured digital platforms exist in this trade corridor. Competition is mainly from fragmented, informal systems.

→ Currently low, but could increase if Borderless proves successful.

Conclusion: Competitive Intensity = Moderate to High

Force	Intensity
Threat of New Entrants	Moderate
Bargaining Power of Suppliers	Low
Bargaining Power of Buyers	High
Threat of Substitutes	High
Industry Rivalry	Moderate

Strategic Implication: Borderless must focus on:

- Differentiation through trust, ease, and localization
- Strong partnerships with logistics/customs players
- User education and onboarding

Marketing Strategy



Target Audience

- SMEs & Micro-Exporters in agriculture, textiles food Informal Traders & border merchants (Tindeuf, Nouadlibio, etc.) Cooperatives & Women-led Businesses
- Youth entrepreneurs in e-commerce
- Local Transport & Logistics Operators

Positioning Statement

“Borderless is the first smart platform that empowers traders and SMEs in Algeria and Mauritania to export and import seamlessly—with logistics, customs and payments in one place.”



Key Messaging

- Trust & Security: Transparent pricing, dispute resolution
- Convenience: Smart digital forms, one click shipping
- Growth Tools: Market demand insights
- Inclusivity: Tools for informal and small players

Marketing Channels

Digital Marketing

- Social Media Ads (Facebook, WhatsApp: **تڤتڤت**) mobile-first campaigns
- Local Influencers **مؤثرات محليّة**, Nouakchott.
- SEO & Content: Blogs, trade guides, video explainers (YouTube)

With Cooperatives & Trade Associations

- Co-branded training and referrals
- Radio Spots in rural regions (especially in Mauritania)

Partnership Marketing

- With Cooperatives & Trade Associations
Co-branded training and referrals
- With Government & NGOs: Promote formalization and inclusion initiatives

Customer Acquisition Strategy



- Free First Trade Campaign
First shipment or document processing free
- Referral Rewards
Bonuses for inviting partners

Retention & Loyalty Tactics

- In App Notifications
Trade updates, new buyer alerts for micro-enterprises
- Customer Support via WhatsApp Local team support in Arabic and French
- Virality
Referral rate per user

KPIs	Metric	Key Performance Indicators
User Acquisition	# of registered users (monthly)	
Engagement	# of transactions per user	
Retention	& users active after 3 months	

Source: Designed by the author

1. Borderless feature roadmap and tiered pricing model:

Service Category	Feature	Basic Plan	Pro Plan	Enterprise Plan
Trade Operations	Quotation Requests & Offers	Yes	Yes	Yes
Trade Operations	Document Management	Limited	Yes	Yes
Trade Operations	Shipment Tracking	No	Yes	Yes
Customs & Compliance	Customs Documentation Wizard	No	Yes	Yes
Customs & Compliance	Tariff & Duty Calculator	No	Yes	Yes
Customs & Compliance	Regulation Updates	Yes	Yes	Yes
Communication	Live Chat with Partners	Yes	Yes	Yes
Communication	Language Support (FR/AR/EN)	Yes	Yes	Yes
Communication	Digital Contract Signing	No	Yes	Yes
Marketplace	B2B Product Listings	No	Limited	Yes
Marketplace	Verified Supplier Directory	No	No	Yes

	Trade Activity			
Analytics	Reports	No	Yes	Yes
Analytics	Cost Optimization Insights	No	Yes	Yes
Analytics	Country Comparison Tools	No	Limited	Yes
Financial	E-invoicing	Yes	Yes	Yes
Financial	Payment Gateway Integration	No	Yes	Yes
Financial	Currency Converter & FX Rates	Yes	Yes	Yes
Premium Services	Dedicated Trade Consultant	No	Optional	Yes
Premium Services	API Access	No	No	Yes
Premium Services	Bulk Document Automation	No	No	Yes

Chapter 5: Service and Organization Plan

Service Process – Borderless

1. User Onboarding

- Step 1: Sign Up (via email or WhatsApp)
- Step 2: Select User Type: Exporter / Importer / Logistic Partner

- Step 3: Complete KYC (basic identity and business validation)
- Step 4: Dashboard Access with guided tutorials in Arabic & French and English

2. Product/Service Listing

- Exporters list available goods with:
- Product details, images, pricing, certificates
- Preferred delivery method (pickup, drop-off)
- Importers list demand or browse offers

3. Matching & Deal Confirmation

- Smart algorithm or manual selection to match buyers and sellers
- Chat or call integration to finalize terms
- Deal confirmation via platform interface

4. Logistics Coordination

- Platform suggests pre-vetted logistics partners based on route and speed
- Exporter selects logistics provider and uploads required customs documents
- Borderless auto-generates required forms & checks for regulation compliance

5. Customs & Regulatory Support

- Exporters/importers get automated checklists for each step
- In-app help or live support for certificate of origin, invoices, etc.
- Partner brokers assist in border clearance when needed

6. Payment & Tracking

- Payment secured in escrow (if applicable) or direct via partner gateways
- Real-time shipment tracking visible in dashboard
- Notifications sent via WhatsApp/SMS/app

7. Delivery & Feedback

- Once shipment is received, payment is released
- Both parties rate and review the experience
- Successful transactions build user trust scores and profile badges

8. Support & Dispute Resolution

- 24/7 support team available via chat and voice
- Dispute ticket system to handle delays, issues, or non-compliance
- Mediation by Borderless or escalation to local authorities (if applicable)

Borderless supply strategy:

A clear and structured Service Process for Borderless, illustrating how users (exporters/importers) interact with the platform from onboarding to completing a cross-border trade transaction:

1. Supply Side Definition

In Borderless, the supply includes:

- Export-ready goods and services from Algerian and Mauritanian SMEs
- Logistics and freight service providers
- Customs brokers and regulatory support agents
- Verified digital services (translation, document preparation, compliance)

2. Key Supply Channels

Supply Element	Description
Local Producers/SMEs	Farmers, artisans, and manufacturers of goods like textiles, dates, seafood, etc.
Aggregators & Cooperatives	Women's groups, youth startups, and micro-enterprise hubs offering goods at scale
Transport Providers	Road transporters, cross-border trucking fleets, and last-mile delivery partners
Customs Service Providers	Licensed brokers, legal experts, and pre-vetted agents at checkpoints

Digital Tools & Infrastructure	APIs and integrations with customs, payment platforms, and mobile operators
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- Regulatory Risk: The platform will hire local compliance consultants and stay updated with bilateral agreements and regional trade policy shifts.
- Adoption Risk: Pilot programs with logistic SMEs and free trials will be deployed to ensure usability and gather early feedback.
- Technical Risk: Built with scalable architecture and cloud-native design, ensuring 99.9% uptime and quick scalability.
- Economic Risk: Flexible pricing plans during economic downturns and regional instability, with diversified client base in both countries.

3. Supplier Acquisition Strategy

- Outreach Campaigns in trade hubs (Tindouf, Adrar, Nouakchott, Nouadhibou)
- Workshops & Webinars for cooperatives and informal traders on how to list/export
- Field Ambassadors to onboard suppliers with phones/tablets (offline-first)
- Partner MOUs with logistics companies, customs brokers, and production clusters

4. Supplier Verification & Quality Control

- Basic KYC & Business Profile
- Product Documentation Review (photos, certificates, export compliance)
- Service Performance Tracking (delivery success rates, delay reports)
- Rating System for logistics and supply-side players (visible to buyers)

5. Supply Growth Strategy

- Incentivized Onboarding (zero listing fees, badges, early support)
- Cluster Development: Identify regional product specialties (e.g. Saharan dates, Mauritanian fish)
- APIs for Partner Warehouses: To enable just-in-time availability and fulfillment

6. Technology to Support Supply

- Supplier Dashboard: Inventory, sales, messaging, document upload
- Smart Matching Engine: Match supply to importer demand by quantity, quality, and route
- Supply Analytics: Trends, performance, product export readiness score

7. Risk Management in Supply

Risk	Mitigation
Product unavailability	Multi-vendor listing, inventory flagging, alerts
Poor service quality	Peer reviews, minimum score threshold for visibility
Regulatory non-compliance	Pre-trade document review + AI rule-checker
Delivery delays	Partner SLAs + auto-replacement options

Key Partnerships – Borderless

A detailed overview of the Key Partnerships for Borderless, highlighting strategic alliances needed to ensure smooth operations, trust-building, and growth across the Algeria–Mauritania trade corridor:

1. Logistics and Freight Partners

Role: Ensure the safe, fast, and reliable movement of goods across borders.

Potential Partners:

- Algerian Transport Firms (e.g., Naouri Group, SARL Logitrans)
- Mauritanian Trucking Companies in Nouadhibou and Nouakchott
- Last-mile delivery startups for rural or inland connections

2. Customs and Legal Advisory Partners

Role: Simplify cross-border procedures and reduce regulatory risk.

Partners:

- Licensed Customs Brokers in both Algeria and Mauritania
- Legal Firms familiar with export regulations and trade law
- Public Customs Authorities for official APIs and clearance integration

3. Financial & Payment Gateways

Role: Facilitate secure, cross-border, and multi-currency transactions.

Partners:

- Local Banks (e.g., Banque Nationale d’Algérie, Banque Populaire de Mauritanie)
- Mobile Payment Providers (CIB, Mobilis Pay, Mauritel, Wari)
- International Transfer Networks (e.g., Western Union, MoneyGram APIs)

4. Tech & Infrastructure Providers

Role: Support the platform’s scalability, uptime, and smart trade features.

Partners:

- Cloud Services (e.g., AWS, Google Cloud)
- AI/ML Tool Providers (for document verification, fraud detection)
- API Integrators (for transport tracking, customs declaration, etc.)

5. Trade Support Organizations

Role: Provide access to traders, exporters, and market validation.

Partners:

- Chambers of Commerce (e.g., CCIA in Algeria, Mauritanian Chamber of Commerce)
- Export Promotion Agencies (e.g., ALGEX)
- NGOs & Development Bodies (e.g., UNDP, GIZ, AfDB)
- Trade Fairs & Exhibitions (for presence and brand visibility)

6. Training and Capacity-Building Partners

Role: Empower users with the knowledge needed for successful trade.

Partners:

- Vocational Training Institutions
- Online Education Platforms (collaborating for exporter onboarding)
- Startup Incubators & Accelerators (Algeria Venture, Startup Mauritania)

7. Media & Outreach Partners

Role: Build trust, educate users, and drive adoption.

Partners:

- Local Radio & TV Channels (broadcast in Arabic, French, and local dialects)
- Social Media Influencers from Algeria and Mauritania
- Regional Business Magazines for featured content

Chapter 6: Integrated Strategic Planning: Business Model, SWOT, and Prospects

This chapter offers an integrated approach to strategic planning for Borderless, combining key analytical tools to assess its structure and future potential. It begins with a detailed presentation of the Business Model Canvas, capturing the essential components that define the platform's value creation and delivery mechanisms. The analysis then moves to a SWOT framework, highlighting internal capabilities and external factors influencing the startup's position in the cross-border

trade ecosystem. The chapter concludes with a forward-looking discussion of the platform's growth prospects and strategic trajectory, grounded in market trends, scalability potential, and regional development dynamics.

Business Model canvas (BMC)

1. Customer Segments

Detailed Description:

- **Small and Medium Enterprises (SMEs):**

Small and medium-sized international trading companies engaged in import/export operations across the Mauritania-Algeria border. These companies need digital tools to facilitate and track their trade processes, especially customs procedures and transportation.

- **Logistics Operators:**

Freight agents, transport companies, and logistics service providers that move goods between the two countries. They require a platform that enables them to coordinate operations efficiently and track shipments in real time.

- **Individual Traders, Importers, and Exporters:**

Individuals or small companies managing border trade looking for transparency, speed in procedures, and reduced administrative costs.

- **Government Entities (B2G):**

Ministries of Commerce and Customs, border control agencies, and economic development institutions that require accurate data and monitoring tools to improve trade regulation and combat smuggling.

- **Indirect Stakeholders:**

Chambers of commerce, NGOs supporting trade and economic development, and international aid organizations.

2. Value Propositions

Detailed Description:

- **For Businesses:**

- A unified digital platform managing the entire external trade process from export to customs clearance.
- Reduced time for completing paperwork and electronic transactions, minimizing shipment delays.
- Real-time shipment tracking, increasing transparency and reducing risks.
- Analytical and forecasting tools that assist better decision-making in logistics operations.

- **For Governments:**

- Collection and analysis of reliable and accurate data on cross-border trade flows.
- Improved monitoring capabilities to combat smuggling and customs fraud.
- Supporting coordination among various government agencies through a shared platform.

- **For the Market and Economic Environment:**

- Supporting regional economic integration by improving the flow of goods.
- Lowering logistical costs and enhancing efficiency in transport and storage operations.
- Enhancing compliance with international trade standards.

3. Channels

Detailed Description:

- **Digital Platform (Website and Mobile Apps):**

User-friendly multilingual interface allowing users to access services anytime and anywhere.

- **Direct Communication:**

Representation offices at border areas with field support to facilitate communication and resolve on-ground issues.

- **Digital Marketing:**

Campaigns on social media, email newsletters, and educational webinars explaining how to use the platform.

- **Customer Support:**

Specialized customer service available through live chat, email, phone, and smart chatbots for instant responses.

4. Customer Relationships

Detailed Description:

- **Dedicated Account Management:**

Support teams and sales reps working with major clients to ensure their needs are met personally.

- **Supported Self-Service:**

An easy-to-use platform with comprehensive guides, tutorial videos, and FAQs to facilitate autonomy.

- **Ongoing Engagement:**

Monthly or quarterly workshops to collect feedback and update services based on user needs.

- **Continuous Technical Support:**

Regular platform updates with 24/7 technical support.

5. Revenue Streams

Detailed Description:

- **Monthly Subscriptions:**

Multiple plans (Basic, Professional, Institutional) tailored to client size and needs.

- **Transaction Fees:**

A percentage fee based on the value or volume of transactions processed through the platform.

- **Premium Services:**

Advanced analytics, integration with ERP and CRM systems, and customized consulting.

- **Government Licenses:**

Annual contracts with government institutions for platform use and data access.

- **Partnerships and Funding:**

Support from development organizations and investment banks as part of economic cooperation programs.

6. Key Resources

Detailed Description:

- **Team:**

Software developers, international trade experts, government affairs specialists, and PR professionals.

- **Technical Infrastructure:**

Cloud computing services, secure databases, AI algorithms.

- **Intellectual Assets:**

Intellectual property rights, custom software, business data.

- **Networks and Partnerships:**

Strong links with government agencies, logistics companies, and economic institutions.

7. Key Activities

Detailed Description:

- Continuous development and maintenance of the digital platform.
- Providing technical support and customer services.
- Building and developing relationships with partners and government entities.
- Conducting market research and data analysis to improve service.
- Organizing user training programs and workshops.

8. Key Partnerships

Detailed Description:

- **Government Entities:** Ministries of Commerce and Customs, border offices, economic development institutions.
- **Logistics and Transport Companies:** Providing freight and storage services.

- **NGOs and International Organizations:** Support, funding, and promotion of the platform within economic circles.
- **Tech Companies:** Cloud service providers, software developers.

9. Cost Structure

Detailed Description:

- Salaries for staff, technical teams, and administrative support.
- Platform hosting and cloud services.
- Marketing, promotion, and brand building expenses.
- Legal, regulatory, and compliance costs.
- Daily operational and infrastructure expenses.

SWOT Analysis

Strengths	Weaknesses
- Innovative platform tailored for local and regional markets.	- Heavy reliance on regulatory and government policy developments.
- Dual business model targeting companies and governments.	- Digitization level in the market still limited.
- Strong partnerships with public and private sectors.	- Continuous investment needed in technology development.

Opportunities	Threats
- Supporting regional economic integration through digital facilitation.	- Resistance from traditional players and informal markets.
- Increased funding and support from international and development agencies.	- Potential competition from other international or regional platforms.
- Growing demand for reliable technological solutions in foreign trade.	- Data security and privacy risks.

Future Outlook

The *Borderless* startup is strategically positioned to catalyze a paradigm shift in cross-border trade between Mauritania and Algeria, and eventually across the broader Sahel and Maghreb regions. By addressing the core barriers to economic integration—bureaucratic inefficiencies, lack of transparency, and institutional fragmentation—*Borderless* offers a digital, interoperable, and inclusive platform that aligns with regional development goals.

Through its hybrid B2B2C and B2G model, *Borderless* creates shared value for both businesses and public stakeholders. The platform's core strengths—real-time logistics monitoring, integrated trade documentation, and data-driven decision-making tools—provide a competitive advantage in environments that are increasingly demanding digital accountability and efficiency.

responsibly, and continually innovate to meet the evolving needs of its stakeholders.

1. Key Strategic Advantages:

- A **dual-market focus** (B2B2C and B2G), ensuring diversified revenue streams;
- A **cloud-native and API-centric architecture**, which enables modular scaling across markets;
- **Strong alignment with international development goals**, particularly the African Continental Free Trade Area (AfCFTA), the UN Sustainable Development Goals (SDGs 8, 9, 17),⁵⁸ and the World Bank's Trade Facilitation Agreement⁵⁹.

2. Future Roadmap (2025–2027):

Phase	Strategic Focus	Key Outcomes
Q3 2025	Pilot launch on key Mauritania-Algeria trade corridors	Proof of concept, first paying clients
2026	Expansion to secondary corridors and integration with national customs APIs	Regional brand recognition, increased transaction volume
2027	West Africa regional scale-up (e.g., Mali, Niger) and partnership with AfCFTA and donors	Institutional contracts, entry into pan-African logistics networks

1. ⁵⁸ World Bank, "Trade Facilitation and Logistics" – <https://www.worldbank.org/en/topic/tradefacilitation>

2. ⁵⁹ United Nations Sustainable Development Goals. <https://sdgs.un.org/goals>

3. Value Chain Integration Diagram:

[Traders & SMEs]



[Borderless Platform]

↳ Trade document management

↳ Real-time shipment tracking

↳ API integration with customs



[Public Authorities / Donors]

↳ Data analytics & policy dashboards

↳ Licensing & compliance enforcement

4. Investor Considerations:

- **Market traction:** Rising demand for trade digitalization in Africa, with logistics tech investment growing +40% annually since 2020^{[3].⁶⁰}
- **Exit potential:** Acquisition by logistics giants (e.g., DP World, Maersk TradeLens) or regional integration platforms.
- **Social ROI:** Enhanced formalization of informal trade, increased tax revenues, job creation in underserved regions.
- **Individual Traders, Importers, and Exporters:**
Individuals or small companies managing border trade looking for transparency, speed in procedures, and reduced administrative costs.

3. ⁶⁰ Partech Africa Report 2024 – <https://partechpartners.com/insights/africa-tech-venture-capital-report/>

- **Government Entities (B2G):**

Ministries of Commerce and Customs, border control agencies, and economic development institutions that require accurate data and monitoring tools to improve trade regulation and combat smuggling.

- **Indirect Stakeholders:**

Chambers of commerce, NGOs supporting trade and economic development, and international aid organizations.

5. Long term reinforcement

The startup's long-term viability is reinforced by:

- **A scalable and modular architecture**, enabling gradual expansion to other corridors and African trade zones (e.g., ECOWAS, AfCFTA).
- **A multi-stakeholder engagement strategy**, including customs, ministries, SMEs, and development agencies.
- **Alignment with Sustainable Development Goals**, particularly SDG 8 (Decent Work), SDG 9 (Industry, Innovation, Infrastructure), and SDG 17 (Partnerships for the Goals).

6. Future priorities

Going forward, *Borderless* will prioritize:

1. **Piloting and gradual deployment**, focusing first on high-volume trade routes;
2. **Building trust through regulatory compliance**, cybersecurity, and co-designed services;

3. Raising strategic funding to support growth, innovation, and regional influence.

In conclusion, *Borderless* is not merely a logistics platform—it is a vehicle for economic transformation, regional integration, and digital sovereignty in West and North Africa. Its success will depend on its ability to navigate institutional complexity, scale applicable)

Chapter 7: financial plan

Estimated costs for **Borderless** over the first five years:

initial business number

Category	Description	Year 1 (€)	Year 2 (€)	Year 3 (€)	Year 4 (€)	Year 5 (€)
Personnel	Salaries (2–4 staff)	24000	30000	45000	60000	80000
Infrastructure	Hosting & servers	1800	2400	3000	4000	5000
Marketing	Digital & event promotion	4000	6000	8000	10000	12000
Support/Admin	Customer support & admin tools	3000	4000	5000	7000	9000
Legal/Compliance	Regulatory, licensing, GDPR, etc.	1000	1000	1500	2000	2000
Miscellaneous	Training, subscriptions, travel	1200	1500	2000	2500	3000
CapEx	Development & infrastructure upgrades	36000	5000	7000	0	0

1. Borderless OpEx:

Year	Salaries (€)	Hosting & Maintenance (€)	Marketing (€)	Support/Admin (€)	Legal/Compliance (€)	Miscellaneous (€)	Total OpEx (€)
1	24000	1800	4000	3000	1000	1200	35000
2	30000	2400	6000	4000	1000	1500	44900
3	45000	3000	8000	5000	1500	2000	63500
4	60000	4000	10000	7000	2000	2500	85500
5	80000	5000	12000	9000	2000	3000	111000

1. Borderless CapEx:

Year	App Development (€)	Infrastructure Setup (€)	Software Licenses (€)	Total CapEx (€)
1	30000	4000	2000	36000
2	0	3000	2000	5000
3	0	4000	3000	7000
4	0	0	0	0
5	0	0	0	0

capEx: capital expenditures

refers to the money spends by a business on acquiring, upgrading, or maintaining physical and intangible assets that will be used over long term.

In this case Borderless CapEx typically includes:

App development costs (coding, design, architecture)

- Software licenses (for tools used in building or securing the app)
- Server infrastructure setup (e.g., cloud configuration, database servers)
- Office equipment (if any physical location or hardware is needed)

CapEx differs from OpEx (Operating Expenses), which are the recurring costs of running the business, like salaries, rent, hosting fees, and customer support

B2B product listings refer to an online catalog or marketplace section where businesses list their products or services for sale to other businesses, not directly to individual consumers.

B2B Product Listings in Borderless:

- Exporters and manufacturers in Mauritania and Algeria can list their products (e.g., fish, dates, textiles, machinery).
- Each listing includes product details, price, minimum order quantity, delivery terms, and photos.
- Importers or wholesalers from either country can search, compare, and request quotes directly through the app.

Benefits:

- Connects verified businesses across borders.
- Increases visibility for local producers and suppliers.
- Enables smooth negotiation

Revenue Projections

1.1 Subscription Revenue

Year	Clients	Monthly Fee	Annual Revenue
1	50	\$100	\$60,000
2	75	\$100	\$90,000
3	112	\$100	\$134,400
4	168	\$100	\$201,600
5	252	\$100	\$302,400

Formula: Clients = Clients (prev. year) $\times$ 1.5

Monthly Revenue = Clients $\times$ \$100

Annual Revenue = Monthly Revenue $\times$ 12

1.2. Transaction Fee Revenue

Year	Monthly Transactions	Annual Transactions	Fee/Tx	Annual Revenue
1	500	6,000	\$10	\$60,000
2	700	8,400	\$10	\$84,000
3	980	11,760	\$10	\$117,600
4	1,372	16,464	\$10	\$164,640
5	1,921	23,052	\$10	\$230,520

Formula: Monthly Transactions = Prev. Year $\times$ 1.4

Annual = Monthly $\times$ 12

1.3 Total Revenue

Year	Subscription Revenue	Transaction Revenue	Total Revenue
1	\$60,000	\$60,000	\$120,000
2	\$90,000	\$84,000	\$174,000
3	\$134,400	\$117,600	\$252,000
4	\$201,600	\$164,640	\$366,240

Year	Subscription Revenue	Transaction Revenue	Total Revenue
5	\$302,400	\$230,520	\$532,920

Operating Expenses

Expense Category	Year 1	Year 2	Year 3	Year 4	Year 5
Salaries & Staff	\$50,000	\$57,500	\$66,125	\$76,043	\$87,449
Tech & Infrastructure	\$15,000	\$17,250	\$19,838	\$22,813	\$26,235
Marketing & Customer Acq.	\$10,000	\$11,500	\$13,225	\$15,209	\$17,490
Admin & Compliance	\$5,000	\$5,750	\$6,613	\$7,605	\$8,746
Total Expenses	\$80,000	\$92,000	\$105,801	\$121,671	\$139,920

All expenses increase 15% annuall

Profit & Loss Statement

Year	Total Revenue	Total Expenses	Net Profit (before tax)	Tax (15%)	Net Profit
1	\$120,000	\$80,000	\$40,000	\$6,000	\$34,000
2	\$174,000	\$92,000	\$82,000	\$12,300	\$69,700
3	\$252,000	\$105,801	\$146,199	\$21,930	\$124,269
4	\$366,240	\$121,671	\$244,569	\$36,685	\$207,884
5	\$532,920	\$139,920	\$393,000	\$58,950	\$334,050

Break-even Analysis

- **Break-even Point:** Achieved by **end of Year 3**
- **Cumulative Net Profit at Year 3:** \$228,969
- **Initial Investment (\$100,000)** recovered in **Year 3 Q4**

Key Financial Ratios

Metric	Value (Year 3)
Gross Margin	58%
Net Margin	49.3%
Return on Investment (ROI)	229% (Year 3)

Metric	Value (Year 3)
Customer Lifetime Value (LTV)	~\$1,600 (3+ years)
Customer Acquisition Cost	~\$200 (est.)

Currency & Crypto Risk Notes

Operations will be multi-currency:

- **USD:** Main reporting and stable financial baseline.
- **DZD** and **MRU:** Used locally; susceptible to inflation and FX volatility.
- **USDT:** Used for blockchain-based remittances; hedges against fiat devaluation, but involves crypto regulation and custodial risks.

Mitigation: FX hedging tools, stablecoin integration, dynamic pricing in local currencies.

Borderless is financially feasible under the outlined assumptions. The model shows healthy growth in revenue and profitability, reaching break-even within three years, and exceeding a 3x ROI by Year 5.

Chapter 8: Technical plan

Borderless Application

1. Application Overview

- Name: Borderless
- Type: Cross-border E-commerce & Trade Platform
- Target Regions: Algeria, Mauritania, Global Markets
- Platforms: Mobile App (iOS & Android), Web App
- Objective: Digitize and simplify import/export operations with smart, secure, and multilingual support.

2. Language Support

- Arabic (RTL support)
- French
- English
- Dynamic Language Switching in UI and onboarding

Users can switch languages at any time from the settings menu or during onboarding.

3. Currency & Payment Options

Supported Currencies

- USD – United States Dollar
- DZD – Algerian Dinar
- MRU – Mauritanian Ouguiya

- USDT – Tether (TRC20/ERC20)

Currency is automatically selected based on the user's location, with manual override option.

Payment Gateways

- Bankily (Mauritania) – Wallet-to-wallet, SMS OTP •

Real-time integration via API.

- BaridiMob (Algeria) – EDAHABIA card, QR, IBAN
- Credit/Debit Cards (Visa/MasterCard – 3D Secure authentication)
- Fraud protection layer via PCI-DSS compliant provider
- USDT Payments – On-chain P2P with wallet connection (TRC20/ERC20)
- QR code payments and wallet address transfer
- Instant confirmation with gas fee tracking

4. Key Technologies & Innovations

A. Blockchain (P2P) System

- Peer-to-peer (P2P) smart contract-based transactions
- Crypto wallet integration
- Transparent, traceable trading ledger for user confidence

B. Cloud Computing

- Hosted on AWS Cloud / Azure
- Auto-scaling infrastructure
- 99.9% uptime SLA
- Secure multi-region data centers (Africa + Europe)

C. Artificial Intelligence Support

- AI chatbot for multilingual customer service
- Smart product recommendations & fraud detection
- Predictive analytics for logistics optimization

D. Cybersecurity

- AES-256 Encryption
- PCI-DSS compliant payment layer
- Biometric Security (Face ID, Fingerprint)
- Two-Factor Authentication (2FA)
- Real-time anomaly detection

E. Big Data

- Data lakes for user behavior and market trends
- Customizable dashboards for sellers
- Exportable reports for cross-border trade insights
- Real-time analytics on shipment, transactions, and pricing

5. Biometric and Access Control

- Face ID / Touch ID authentication
- Multi-role User Access System (buyer, seller, admin, customs agent)

6. Regulatory Compliance

- IFRS 19 – Insurance Contracts (if you're referring to insurance-based revenue recognition for logistical guarantees or product protection, IFRS 19 aligns the platform's insurance-related income and obligations)
- GDPR, NDPR (Africa), Local Data Protection Laws
- KYC/AML integrated for secure transactions

7. Additional Features

- Real-time Currency Conversion API
- Live Order Tracking
- Notifications: Email, SMS, In-App
- In-app Communication (Chat + AI Bot)
- Dynamic Logistics Partner Integration
- Product Verification Tags (QR/Blockchain)

8. Security & Compliance

- Data Encryption: AES-256 end-to-end

- Payment Security: PCI-DSS compliance, tokenization for card data
- User Verification: KYC (Know Your Customer) for large transactions
- GDPR/Local Data Regulations: Full compliance in both Algeria and Mauritania

9. Additional Technical Features

- Real-Time Currency Conversion API
- Multi-Language & RTL Support (Right-to-Left for Arabic)
- Order Tracking & Notifications (SMS, Email, In-app)
- Chatbot & Live Support Integration
- Role-Based Access for Buyers, Sellers, and Admins

Proposed Business Identification Number – Borderless

Business Number Structure for Borderless, tailored for use in Algeria and Mauritania. This number can serve for administrative, tax, and regulatory registration purposes and can also be part of your internal documentation system:

Format: BL-2025-DZMR-0001

Structure Explanation:

- BL: Abbreviation for Borderless
- 2025: Year of official registration/start

- DZMR: Indicates Algeria (DZ) and Mauritania (MR) collaboration
- 0001: Unique sequential number (for branch, user, or registration tracking)

Examples:

- BL-2025-DZMR-0001 → Main headquarters
- BL-2025-DZMR-0002 → Logistics partner in Tindouf
- BL-2025-DZMR-1001 → First verified exporter user
- BL-2025-DZMR-S001 → First service provider (e.g., customs partner)

Business Number	Entity Name	Type	Country	Status
BL-2025-DZMR-0001	Borderless HQ	Main Office	Algeria	Active
BL-2025-DZMR-0002	Tindouf Logistics Hub	Branch Office	Algeria	Active
BL-2025-DZMR-1001	Zeinab Exports (Algeria)	Exporter	Algeria	Verified
BL-2025-DZMR-1002	Abdallahi Enterprises (Mauritania)	Exporter	Mauritania	Pending Verification
BL-2025-DZMR-S001	DZ Customs Pro	Service Provider	Algeria	Active
BL-2025-DZMR-S002	MR Freight Partners	Service Provider	Mauritania	Active

Prototype see appendix 4

Chapter 9: Barriers and Challenges of “Borderless”

1. Regulatory and Legal Challenges

- **Bureaucracy and Red Tape:** Both Algeria and Mauritania have complex customs and trade regulations, often with inconsistent enforcement.
- **Lack of Trade Harmonization:** Differences in documentation, duties, and approval processes create friction in cross-border transactions.
- **Limited E-commerce Legislation:** Absence or weak enforcement of digital trade laws, online consumer protection, and dispute resolution frameworks.

2. Infrastructure and Logistics

- **Poor Transport Networks:** Underdeveloped Road and rail connections, especially in southern Algeria and northern Mauritania.
- **Border Crossing Delays:** Customs inefficiency, manual inspections, and a lack of digitization at border posts.
- **Logistics Providers' Gaps:** Limited presence of reliable last-mile delivery companies, especially in rural areas.

3. Technological Barriers

- **Digital Divide:** Inconsistent internet access and low digital literacy among some user segments (e.g., rural traders or traditional exporters).
- **Integration Complexity:** Difficulty integrating with customs, banks, and logistics APIs in two different countries.
- **Cybersecurity Concerns:** Trust issues around online payments, digital document storage, and fraud prevention.

4. Financial Challenges

- **Payment System Barriers:** Weak cross-border digital payment infrastructure, limited use of credit cards, and restrictions on currency exchange.
- **Access to Capital:** Difficulty obtaining startup funding or loans from banks in Algeria and Mauritania.
- **High Transaction Costs:** Currency conversion fees, tariffs, and border handling charges that affect pricing competitiveness.

5. Market and Cultural Challenges

- **Trust and Adoption:** Low awareness or skepticism towards e-commerce, especially for high-value export/import transactions.
- **Language and Business Culture:** Differences in business etiquette, local dialects, and negotiation styles can impact communication.
- **Lack of Skilled Workforce:** Scarcity of local talent with experience in supply chain tech, international trade, and digital platforms.

6. Political and Security Risks

- **Geopolitical Instability:** Political shifts or tensions in either country could impact cross-border trade policies.
- **Security at Trade Routes:** Smuggling, banditry, or unsafe roads in remote desert zones may disrupt transport routes.

Final Word of the founder

Borderless is not just a logistic platform—it is an enabler of inclusive trade, transparency, and regional sovereignty. With a clear go-to-market strategy, a strong founding team, and support from institutional partners, the startup is poised for sustainable growth and high-impact delivery across Africa's emerging digital corridors.

Borderless combines innovation, strategic positioning, and strong demand fundamentals to transform trans-Saharan trade. With its hybrid B2B2C and B2G approach, the startup aims not only for profitability but also for regional impact

through trade facilitation and economic integration, by reducing administrative friction, increasing transparency, and enhancing logistics coordination, ***Borderless*** is not merely optimizing transactions: it is enabling economic integration and regional resilience.

Conclusion

In an increasingly interconnected and competitive global economy, the efficiency of export and import supply chains has become a critical determinant of national and business-level success. This research has demonstrated that modern technologies — including artificial intelligence, blockchain, the Internet of Things (IoT), cloud computing, and e-commerce platforms — play a transformative role in addressing long-standing inefficiencies in trade logistics, visibility, traceability, and coordination.

The study underscored how technological innovation is not only improving logistics performance but also redefining trade dynamics and competitiveness.

Through a deep examination of current practices, focusing on the context of developing countries particularly Algeria and Mauritania, the study has shown that technological integration is no longer a luxury, but a strategic necessity. These technologies reduce delays, lower operational costs, improve compliance with international trade standards, and enhance customer satisfaction — all of which contribute directly to trade growth and economic resilience.

The practical culmination of this research is the startup project Borderless, which embodies the core findings of the study. Borderless is designed as a digital platform to bridge logistical, regulatory, and market-access gaps between exporters and importers across borders, especially in under-digitalized regions. It leverages smart logistics, real-time tracking, automated documentation, and an intelligent matching system to streamline B2B export-import interactions between Algeria and Mauritania — and beyond.

Key Findings

1. Modern technologies such as IoT, blockchain, AI, and cloud-based systems significantly enhance visibility, traceability, and automation in supply chains, reducing lead times and operational costs.
2. Digital platforms and e-commerce models, when integrated into export-import operations, facilitate smoother cross-border transactions, better market access, and more responsive logistics systems.
3. Developing countries face challenges such as digital infrastructure gaps, regulatory inconsistencies, and limited technical capacity, which hinder the full adoption of technological solutions.
4. The case of Borderless, a tech-based platform connecting Algerian and Mauritanian exporters and importers, demonstrates that localized, user-friendly digital solutions can overcome many traditional trade barriers, particularly in fragmented logistics networks.

Suggestions:

✓ For Policymakers:

- Invest in digital infrastructure and logistics hubs, particularly in border regions and key ports.
- Harmonize customs procedures and promote regional digital trade agreements.
- Support startups and SMEs through incentives and regulatory sandboxes focused on trade technologies.

✓ **For Businesses and Logistics Providers:**

- Adopt integrated digital supply chain solutions to increase transparency, responsiveness, and data-driven decision-making.
- Train workforce on digital tools and platforms to improve adoption and utilization.
- Collaborate with tech startups like Borderless to co-develop customized solutions that address real field challenges.
- For Borderless and Similar Startups:
 - Focus on building trust through transparent, secure, and reliable services, including real-time tracking and digital documentation.
 - Scale progressively, starting with key trade corridors and expanding regionally.
 - Use data analytics to offer value-added services such as demand forecasting, risk alerts, and customer intelligence.

Future Tendencies:

Looking ahead, the future of export-import logistics is moving toward:

- Hyperconnected, smart supply chains, where real-time data flows seamlessly between partners.
- Decentralized platforms using blockchain to ensure document integrity and reduce fraud in customs and payments.

- AI-powered trade intelligence, offering predictive insights for demand, disruptions, and pricing.
- Green logistics and sustainability tech, aligning with global climate goals and customer expectations.
- Platform-based trade ecosystems like Borderless, enabling small businesses in developing economies to integrate into global value chains.

Ultimately, this thesis affirms that unlocking supply chain efficiencies is not solely about technology deployment, but also about rethinking processes, fostering public-private collaboration, and building digital trust across borders. The future of trade lies in platforms like Borderless, which empower local exporters to compete globally through accessible, reliable, and tech-enabled logistics ecosystems.

Final thought

Unlocking supply chain efficiencies is no longer just about faster deliveries, exchanging products, — it's about enabling inclusive, secure, and data-driven trade. The convergence of logistics innovation and digital entrepreneurship, as embodied in Borderless, signals a promising shift toward more equitable and agile global commerce. This thesis provides a foundational roadmap for leveraging modern technologies to bridge the gap between local potential and international opportunities.

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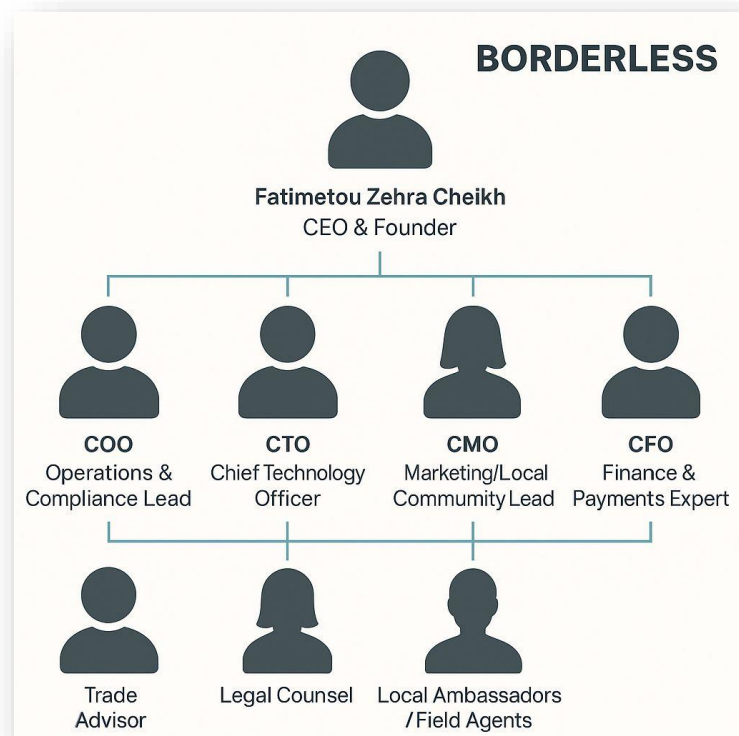
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Appendixes

Appendix 1: the logo of the application



Appendix 2: The Team Org Cart



Appendix 3: BMC resume

1. Customer Segments

- Small and medium import/export businesses
- Individual traders
- Freight and logistics companies
- Customs and trade authorities (government)

2. Value Propositions

- Streamlined, digitized import/export processes
- Real-time tracking and documentation
- Enhanced trade data analytics
- Cost and time savings for traders
- Improved regulatory compliance and monitoring for governments

3. Channels

- Website and mobile app
- Strategic partnerships with trade agencies
- Trade fairs and conferences
- Online marketing and direct outreach

4. Customer Relationships

- Dedicated account managers for B2G clients
- Automated support through chatbots and FAQs

- Live support and onboarding for SMEs

5. Revenue Streams

- Subscription fees (B2B2C)
- Licensing and integration fees (B2G)
- Premium service charges (legal advice, analytics, etc.)

6. Key Resources

- Development and tech team
- Data infrastructure and cloud services
- Trade and compliance experts
- Strategic government and business liaisons

7. Key Activities

- Platform development and maintenance
- Regulatory and trade compliance monitoring
- Customer acquisition and support
- Government engagement and integration

8. Key Partnerships

- Ministries of trade, customs, and commerce
- Logistics and freight associations
- Financial institutions for secure transactions

9. Cost Structure

- Platform development and cloud hosting
- Salaries and operations
- Legal and regulatory costs
- Marketing and partnership development

Appendix 4: Prototype



Borderless

Commerce without limits, Growth without borders



Two-finger long press anywhere to open menu

9:41 AM



Search products, brands,
sellers...



All

Electronics

Fashion

Home

Beauty

Algerian Products

[See All](#)



Moroccan Leather Bag

\$129.99

★ 4.8 (156)

Marrakech, Morocco



Authentic Berber Carpet

\$349.00

★ 4.9

Fez, Morocco

Mauritanian Products

[See All](#)



Handmade Ceramic Tagine Pot

\$59.50 ~~\$70.00~~

★ 4.6 (78)



Tuareg Silver Necklace

\$120.00 ~~\$150.00~~

★ 4.8 (42)



Home



Market



Orders



Chat

9:41 AM



Borderless



Welcome back, Michael!

Saturday, June 14, 2025



Current Currency
USD

DZD

MRU

USDT

Quick Actions



Buy



Sell



Track



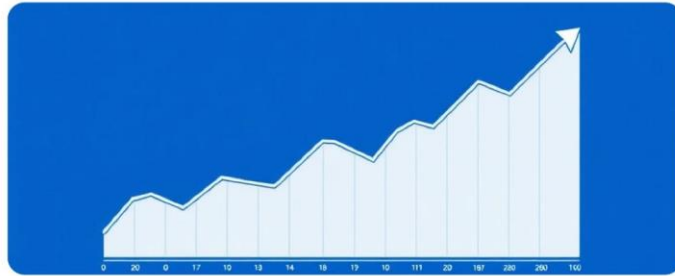
Chat

Market Trends

[See All](#)

Today's Volume
\$1,245,678

↑ 12.4%



Featured Products



Home



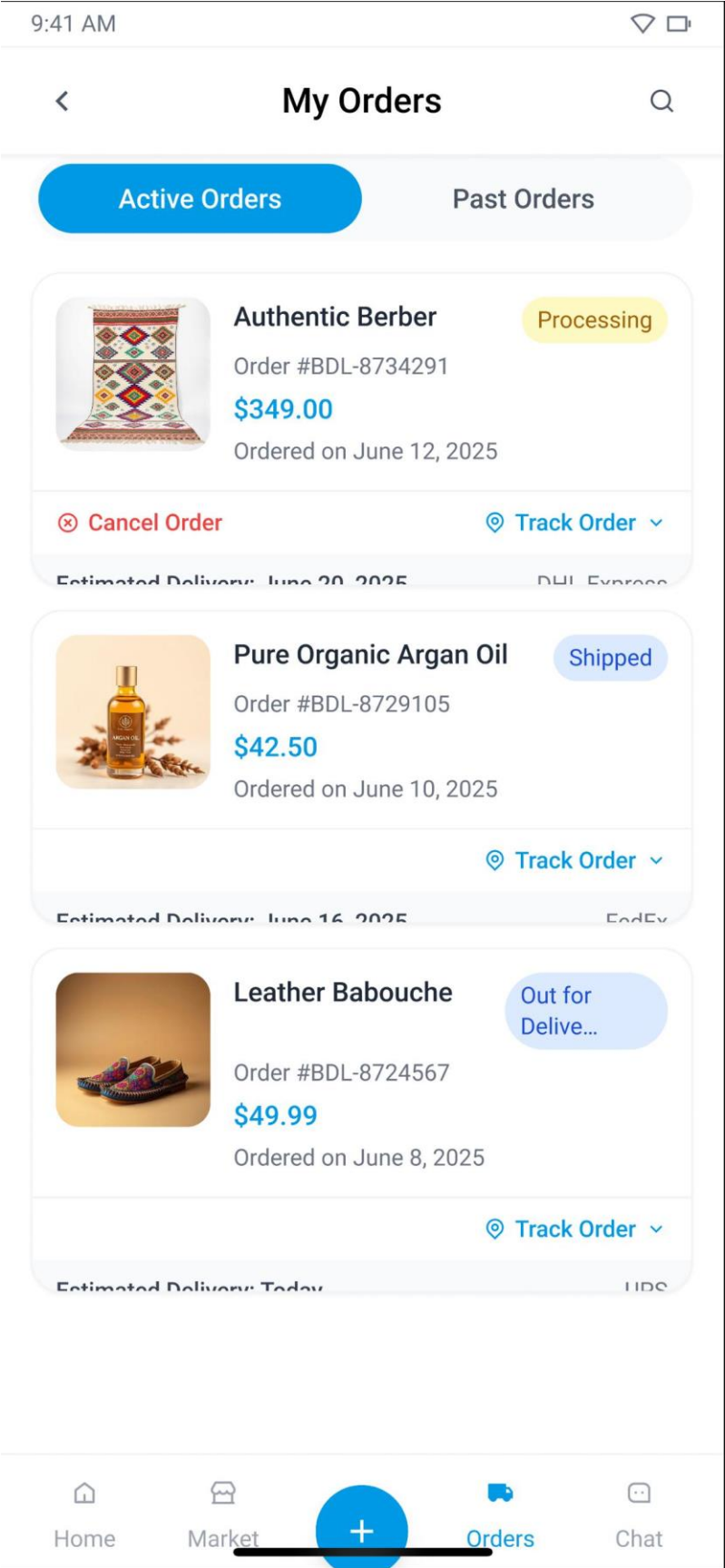
Market



Orders



Chat



9:41 AM



Borderless



Welcome back, Michael!

Saturday, June 14, 2025



Support Assistant
Online



Quick A



Buy

Market

Today's
\$1,245

Type your message...



Featured Products



Home



Market



Orders



Chat

English ▾



Welcome to Borderless

Commerce without limits, Growth without borders

 Email or Phone Number

 Password



[Forgot Password?](#)



Log In

OR



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By continuing, you agree to Borderless's [Terms of Service](#) and [Privacy Policy](#)

Appendix 5: AGNC Agency Architectural Plan



