



Globant ▶

Addressing duplicate invoicing in supply chains

Globalization and millennial consumption trends have revolutionized supply chain management, at the heart of which is its fuel Supply Chain Finance (SCF). While a secure and efficient concept, SCF is afflicted by a notorious plight - Duplicate invoicing.

This report explores the ballooning problem of Duplicate Invoicing, sheds light on its detrimental effects, and delves into the best possible solutions based on emerging technologies.

What are the consequences of duplicate invoicing? Here are some facts:

- **SAP Concur reported** that a typical small or midsize business experiences an invoice duplication rate of 1.29%, or about six duplicate invoices monthly, throwing away as much as \$12,000 a month.
- A **2022 study by OpenEnvoy** highlighted that 8.5% of the invoices companies receive are duplicates, amounting to \$42,124,360 in duplicate billings.
- The Chartered Institute of Procurement & Supply (CIPS) **estimates** that “43% of UK businesses had been subject to duplicate invoices, compared to EMEA averages of 27%”.
- Another study by Liberata found that **duplicate payments make up approximately 1% of all invoices paid**.

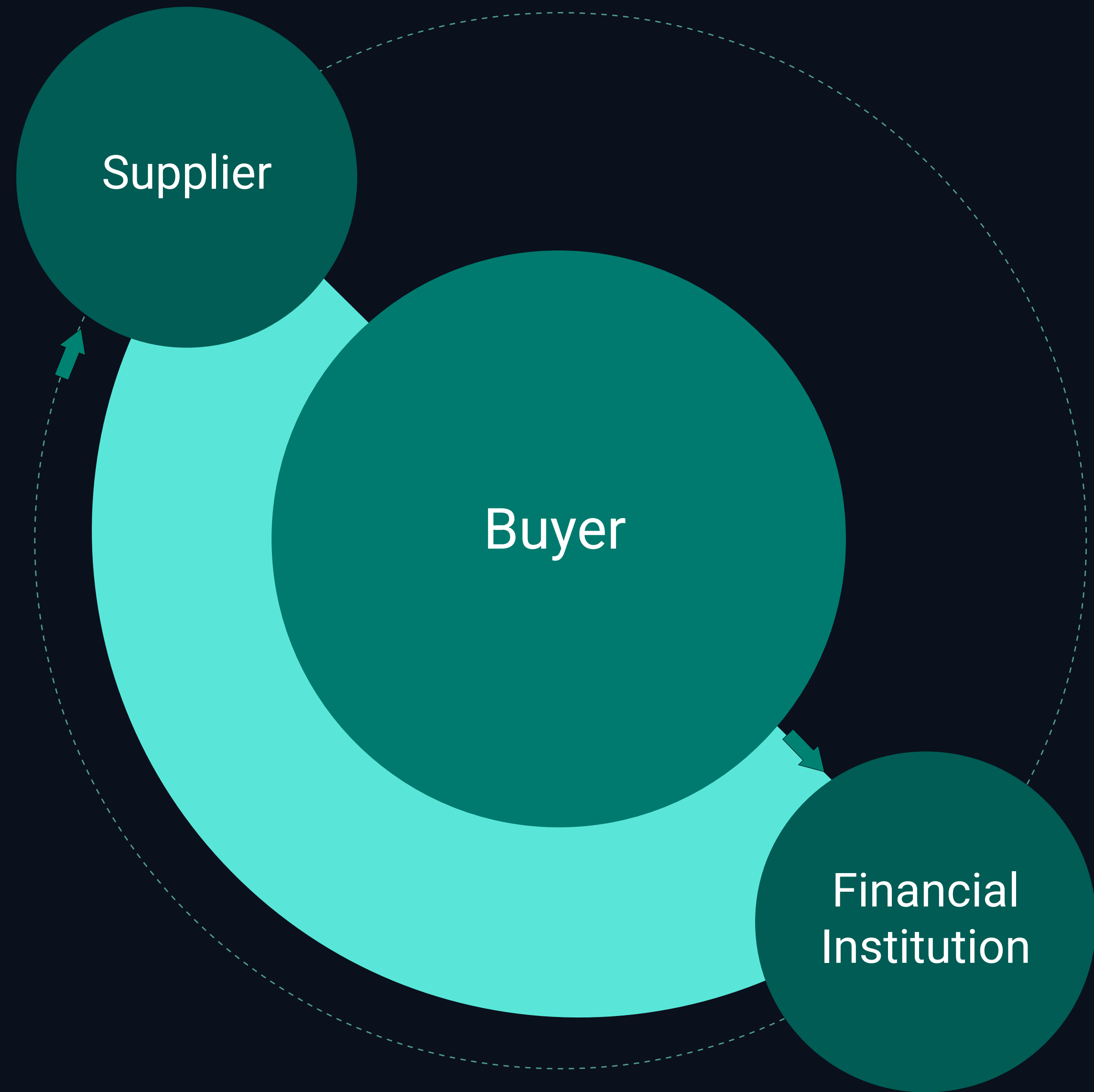
- According to the “**2020 Report to the Nations**,” published by the Association of Certified Fraud Examiners (ACFE), organizations lose an estimated 5% of annual revenue due to fraud.
- False billing/invoicing causes a **median loss of \$100,000**.
- In a **report** by the U.S. Department of Health and Human Services - Medicare allowed an estimated \$2.25 million in duplicate payments for 15 codes in 1998.
- Duplicate invoicing, call it a deceptive practice or an unwanted anomaly, has become an enormous problem disrupting supply chain finance all over the globe. Many **studies** and **news reports** have spread the awareness and impact of this seemingly silent financial plague.

In addition to the already prevalent mishaps, the COVID-19 pandemic brought about a new set of fraud risks to supply chain finance. Many credible publications, such as those by **KPMG** sum up the fraud issues that multiplied during that period and further disrupted the supply chain finance domain all over the world.

Supply Chain Finance

Empowering Supply Chains through Financial Efficiency

Supply chain finance (SCF) is a financial strategy that optimizes cash flow and working capital within a supply chain ecosystem. It involves a financial institution providing early payment options to suppliers based on the creditworthiness of the anchor buyer. This enables suppliers to access faster liquidity and allows buyers to optimize payment terms, fostering a more efficient and stable supply chain.



Manufacturing

An extensive survey of 101 Indian Ministry of Micro, Small & Medium Manufacturing Industries identified their problems.



- Suppliers are forging duplicate invoices to gain double payments.
- Inflation and variation of currency exchange rates affect the financial concern.
- Higher credit rating requirements in bill discounting by third parties.
- Disclosure of sensitive company information leads to competitors getting access to sensitive company data.

Healthcare

The largest Indian-owned healthcare firm has carried out SCF initiatives for the past ten years but has faced many challenges.



- Invoice duplicity due to lack of automation of invoicing and payment processes.
- Pressure to reduce the cost of finished medicine or medical products to be competitive in the market.
- Need for more reliable and predictable cash flow.
- Non-effective inventory management technique.

Banking

The International Chamber of Commerce (ICC) Banking Commission's latest edition of its Global Survey on Trade Finance provides an authoritative review of global trade finance trends based on interviews from over 300 banks in over 90 countries. Here are some of the challenges banks face today.



- Duplicate invoice detection in 1 million invoices.
- Compliance problem because suppliers are not clients of the bank.
- The risk appetite of various parties depends on which supply chain finance technique is applied.
- Cross-border complexities are challenging as the legal construct in various parts of the world is unique.

A person is sitting at a wooden desk, working. Their hands are clasped together, and they are wearing a ring. On the desk, there is a laptop, a calculator, a pair of glasses, and a spiral notebook. The background is slightly blurred, showing a white shirt and a green jacket.

Analyzing the Challenges of SCF

The ensuing **challenges** of SCF are multifold and multi-dimensional, and they differ for each industry/domain. We have identified some of them concerning different industries.

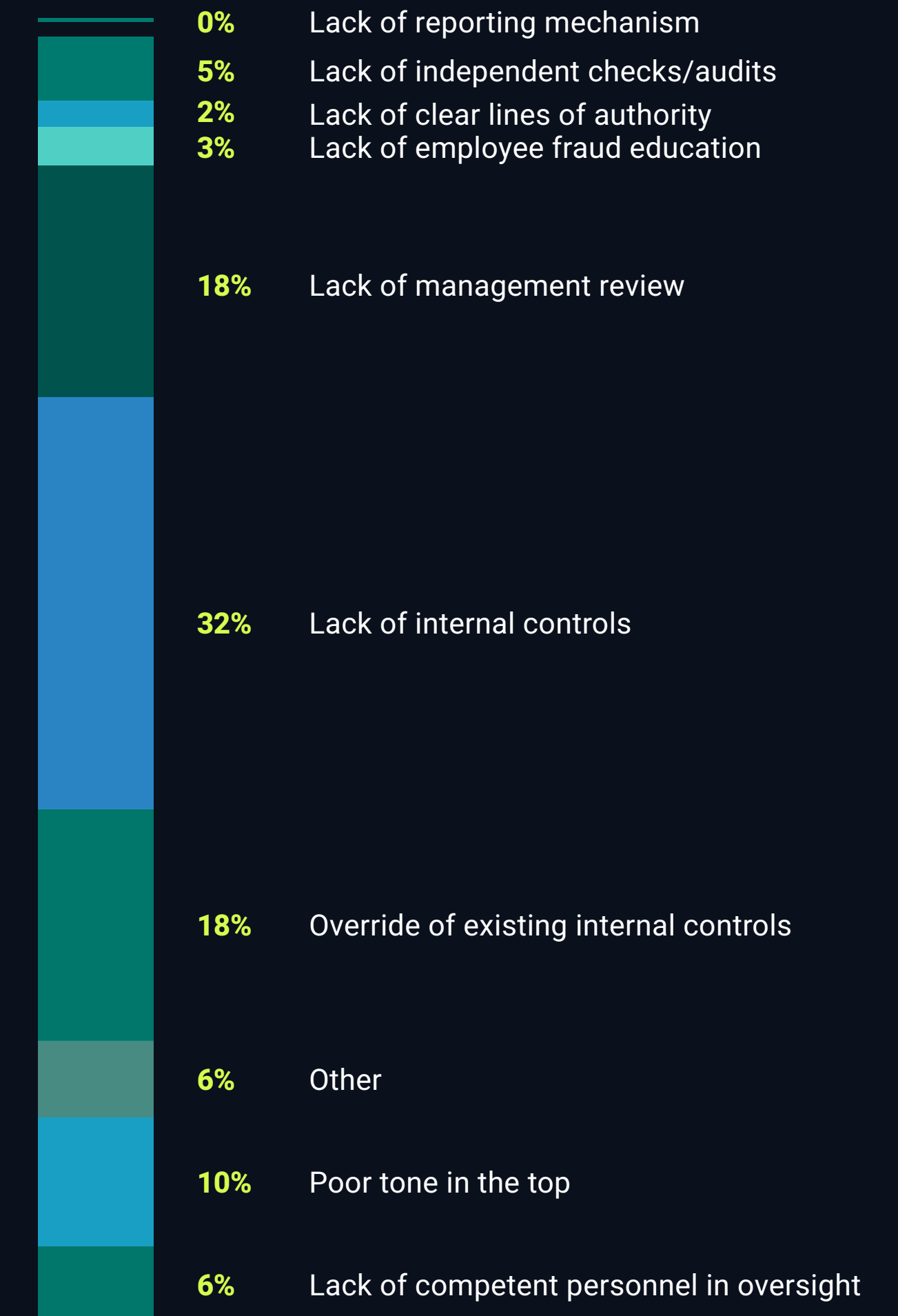
The challenges may differ per industry, and their impact could be severe or inconsequential in managing the cash flows in the chain. However, we identified one common challenge affecting industries - Duplicate Invoicing.

Double invoicing dilemma

Unraveling the emergence of duplicate invoices

The duplication of invoices affects the authenticity of the entire supply chain financing process. Let's analyze the reasons for the emergence of such issues:

- Multiple invoices submitted for the same goods or services with slightly different attributes (invoice numbers, dates, and sometimes amounts).
- Incorrect categorization of invoices between those that have already been paid, those that need to be sent out, and those that are overdue.
- Occasionally, recurring patterns of poor bookkeeping practices lead to double invoicing.
- Duplicate vendors and/or multiple branches of the same business.
- Some entities prefer to send multiple invoices via multiple channels to be thorough and guarantee that clients receive them.
- Ignoring disputes or internal errors regarding invoices may also result in double invoicing.



Source: [ACFE's 2020 Report to the Nations](#)

Understanding the _____ pernicious impact of duplicate invoices on businesses

Duplicate invoicing has a pronounced effect on supply chains while disrupting the supply chain finance as well:

- **Financial Loss:** Suppliers may receive excessive payments for the same invoice, leading to overpayment. Similarly, buyers may incur unnecessary expenses by paying for goods or services they have already settled on. When companies don't detect excessive payment on time, it can become a snowball effect, so it is an issue by the time it is caught.
- **Operational Inefficiency:** Duplicate invoicing creates inefficiencies in the supply chain finance process, requiring extra time and effort to identify and resolve these duplicates. As a result, payment processing is delayed, potentially straining supplier-buyer relationships and overall supply chain effectiveness.
- **Fraud and Misconduct:** Unscrupulous suppliers may submit multiple invoices for the same transaction, aiming to defraud the buyer by receiving excessive payments. This fraudulent activity can undermine trust and integrity within the supply chain ecosystem.
- **Reconciliation Challenges:** It becomes difficult to match invoices with payments accurately, leading to confusion and discrepancies in financial records. This can result in prolonged and complex reconciliation procedures, consuming time and resources.
- **Compliance and Audit Risks:** Inaccurate financial records can lead to regulatory non-compliance, which may attract penalties or legal consequences. Moreover, discrepancies caused by duplicate invoices can raise suspicion and scrutiny during audits, causing disruptions and reputational damage.

Consequently, organizations must enforce robust controls and technologies to mitigate the problem of duplicate invoicing.

Exploring Supply Chain Finance Solutions: A comprehensive market overview

SCF is a set of solutions that optimizes cash flow by allowing businesses to lengthen their payment terms to their suppliers while providing the option for their large and SME suppliers to get paid early. Companies can do this through various mechanisms, such as **reverse factoring**, **dynamic discounting**, and **inventory financing**. The market for SCF solutions is proliferating as businesses become increasingly aware of its benefits.

The global supply chain finance market size reached approximately USD 6.4 billion in 2022. The market is further projected to grow at a CAGR of 8.7% between 2023 and 2028, reaching a value of USD 10.56 billion by 2028.

Currently, some solutions exist in the market to detect duplicate invoicing in SCF:

- **Invoice comparison tools:** They allow businesses to compare invoices side-by-side to identify any similarities. It can be a helpful way to detect duplicate invoices, especially if the invoices are not identical.
- **Invoice data validation tools:** They are helpful to validate invoice data, such as the invoice number, purchase order number, and supplier details. These tools can help to identify duplicate invoices that have been submitted with incorrect data.

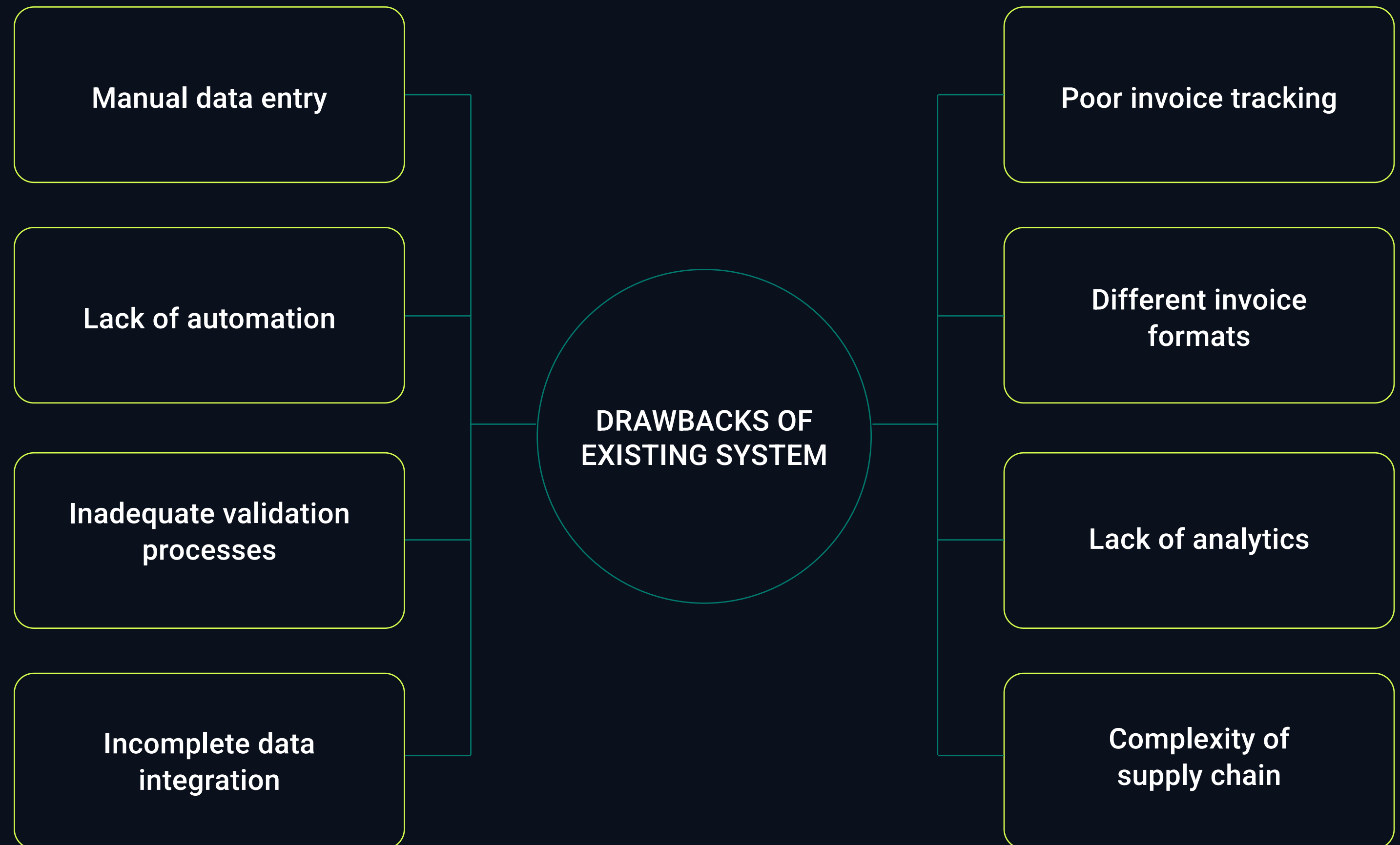
- **Invoice management software:** This software can be used to automate the management of invoices, including the matching of invoices and the detection of duplicate invoices.
- **Enterprise Resource Planning (ERP) Systems:** Many ERP systems include built-in invoice processing modules with duplicate detection capabilities. These modules use predefined validation rules and algorithms to identify duplicate invoices.
- **Data Analytics and Business Intelligence Tools:** Some companies use data analytics and BI tools to detect duplicate invoices by analyzing patterns, outliers, and trends in invoicing data.

By implementing one or more of these solutions, businesses in this industry can mitigate the risk of duplicate invoices and safeguard their baseline.

Identifying Drawbacks in the Current Systems

The extent of the duplicate invoice problem can vary depending on the size and complexity of the supply chain, the number of suppliers, and the level of automation in the invoice processing procedures. Some businesses may face a higher risk of encountering duplicate invoices due to manual data entry, lack of proper validation processes, or inadequate invoice tracking systems.

Most of the techniques involve an exact match on a combination of Supplier + Invoice ID + Invoice Date + Invoice Amount. Addressing duplicate invoice issues requires implementing robust controls and technologies to detect and prevent such occurrences.



“By 2025, 50% of B2B invoices will be processed and paid without manual intervention”. - **Gartner**

It's important to note that the market is continuously evolving, and new solutions have emerged:

- Blockchain-based solutions: Blockchain is a distributed ledger technology that companies can use to track the movement of goods and money in a supply chain. It makes it ideal for detecting duplicate invoices, allowing businesses to see all the invoices submitted for a particular transaction.
- The recommended consensus approaches in blockchain technology to identify duplicate invoices are **Proof of Work (PoW)** and **Proof of Stake (PoS)**. The choice between PoW and PoS depends on transaction speed, security, energy efficiency, and network scalability.
- Automated invoice matching systems: These systems use machine learning algorithms to identify duplicate invoices. The algorithms typically look for patterns in invoice data, such as the invoice number, purchase order number, supplier details, and amounts.
- Fraud detection AI: Fraud detection AI uses machine learning algorithms to identify patterns and anomalies that suggest fraudulent activity. This can include identifying duplicate invoices that fraudulent suppliers have submitted. For Eg - A Random Forest classifier can be used to help identify duplicate invoices by leveraging its ability to handle multiple features and provide a robust decision-making mechanism.



Blockchain: _____

Paving the Way for the Future of the Supply Chain Industry

Over the past few years, blockchain technology has gained traction in supply chain finance. Because of its security and transparency features, it is well-suited for this industry.

As per **Verified Market** research, it is the most used technology in the Supply chain finance Industry, and it will continue to be.

For example, **Walmart** is using the IBM Food Trust platform, which was built using Hyperledger Fabric and runs on the IBM cloud. This technology is used to trace the movement of food products across its supply chain. It helps to ensure that the products are safe and not counterfeit.

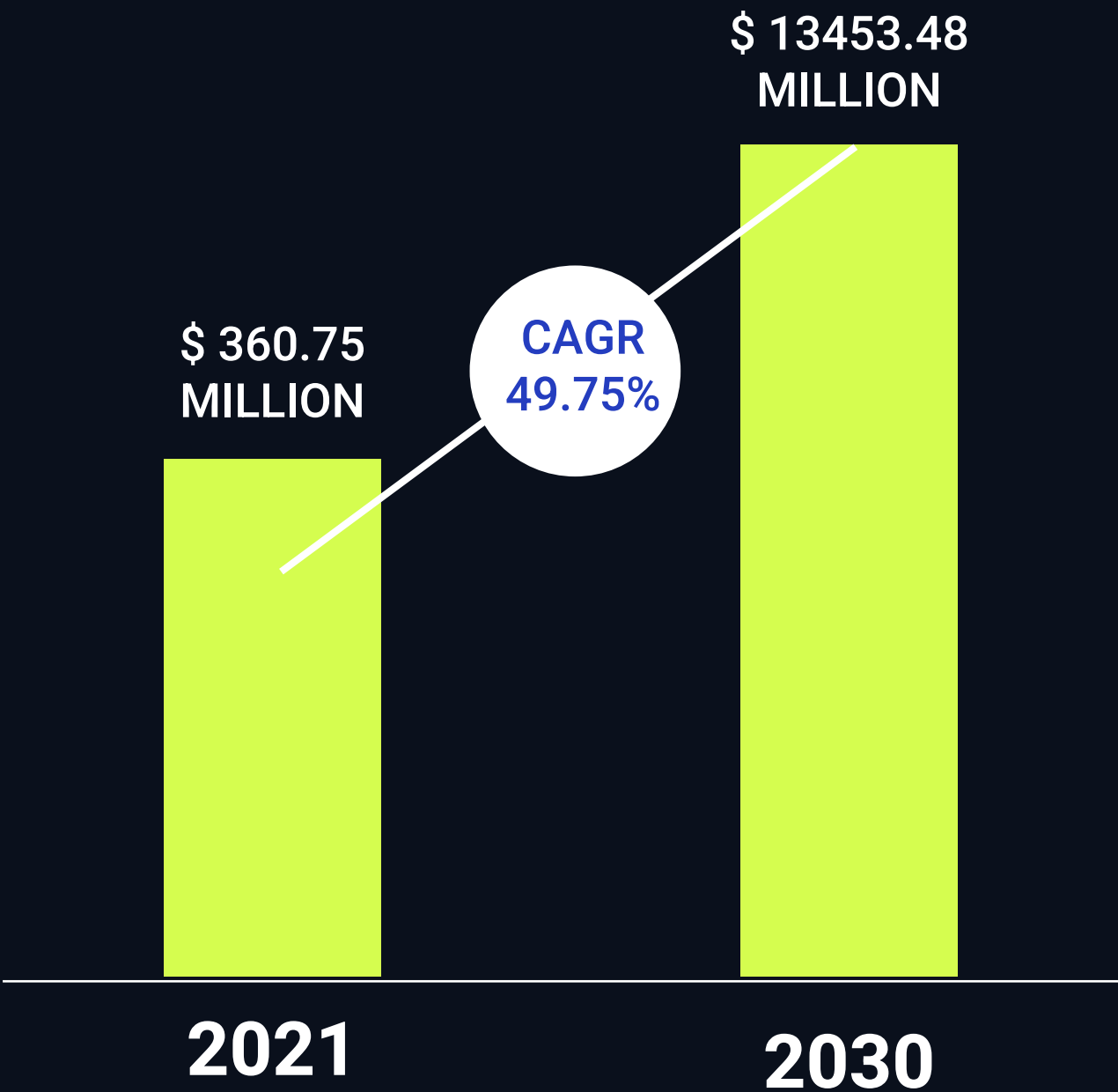
Another example is the use of blockchain by **TradeLens**, a joint venture between IBM and Maersk. TradeLens is a platform to monitor the global movement of goods helping to improve efficiency and transparency in the global shipping industry.

As the technology matures and the challenges are addressed, blockchain will likely become increasingly adopted in the supply chain finance industry. However, it is essential to note that

it is not a silver bullet. Some challenges still need to be addressed before it can be widely adopted in this industry. There currently needs to be a single standard for it which can make it difficult for different organizations to connect and communicate with each other. Also, it remains susceptible to fraudulent activities, including **double-spending attacks** perpetrated by malicious entities. To address this issue, a there is a novel solution that uses artificial intelligence (AI).

GLOBAL BLOCKCHAIN IN SUPPLY CHAIN FINANCE MARKET

2023-2030



Source - Blockchain Supply Chain Market Size And Forecast

AI revolutionizing supply chain finance:
Bridging gaps in blockchain solutions

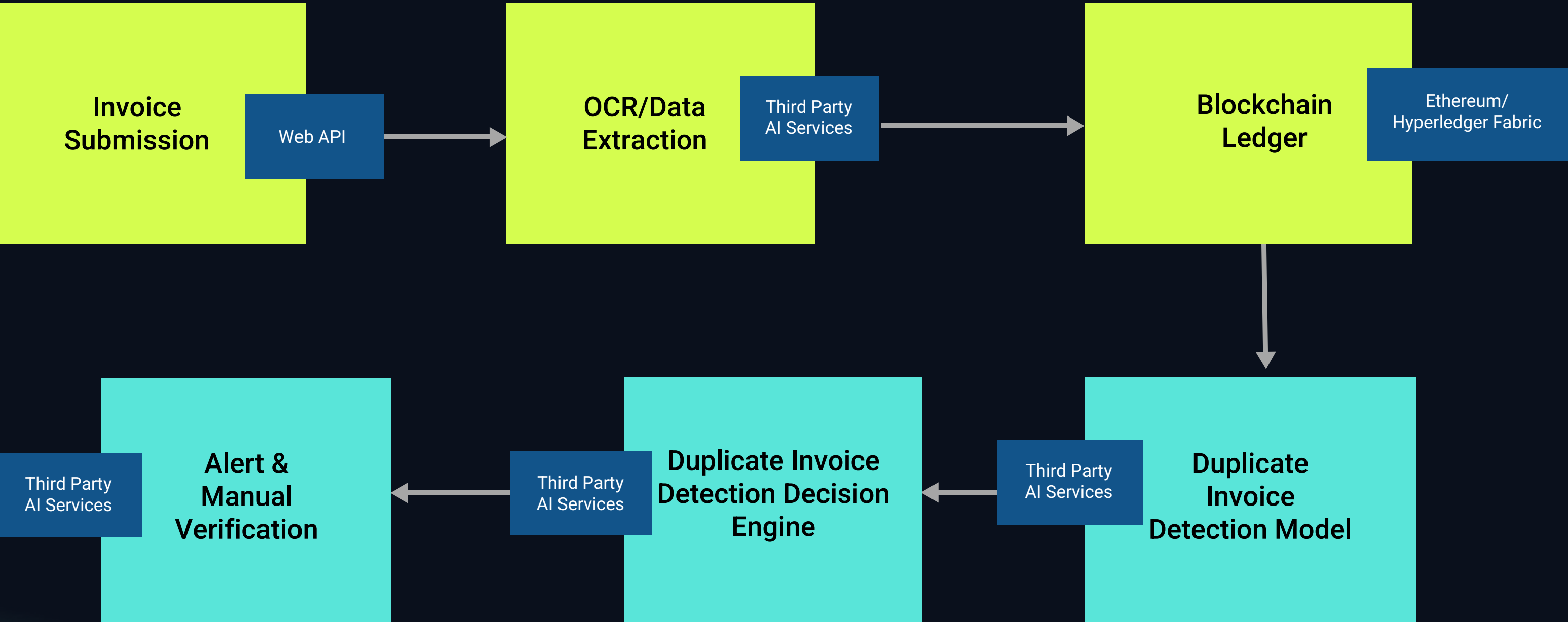
AI and blockchain are distinct technologies with different purposes, and they can serve as complementary components in supply chain finance. It's not a matter of AI overpowering existing blockchain solutions or vice versa, but rather how they can work together to enhance different aspects of the supply chain finance process.

Companies can use AI to analyze invoice data and find trends that point to duplicate invoices. For instance, to distinguish between invoices with the same invoice number or those presented for the same amount of money.

AI can also be used to spot phony duplicate invoices. For instance, to spot invoices filed from various IP addresses or with different payment information.

Automating the matching of bills with AI can lessen the possibility of human error producing duplicate invoices. As a result, businesses can protect their bottom line and improve their supplier relationships.

Let's craft a custom solution to identify the duplicate invoice problem using these two superhero technologies.



- **Invoice Submission:** Invoices are submitted by suppliers or stakeholders into the system for processing and verification. The invoices can be in various formats, including scanned images and digital documents.
- **OCR & Data Extraction:** This component extracts relevant data from invoices, such as vendor names, invoice numbers, dates, and amounts, to enable further processing.

1. Cloud Vision API is a service from Google that extracts text and objects from images.

2. Amazon Textract can perform Optical Character Recognition (OCR) on invoices, extracting relevant text and structured data from the documents.

- **Blockchain Ledger:** The extracted invoices are recorded as transactions on the blockchain, creating a tamper-proof and transparent ledger where each transaction is linked to the previous one, forming a chain. Once a transaction is recorded on

the blockchain, it cannot be altered or deleted, ensuring the integrity of the data.

1. Using Ethereum:

- Ethereum, a public blockchain platform, maintains a decentralized ledger of invoice transactions.
- Each invoice submission generates a transaction on the Ethereum blockchain, cryptographically linked in blocks to ensure transparency and immutability.
- Smart contracts on Ethereum govern the DApp's (Decentralized App) behavior, including functions for adding new invoices and handling duplicate identification.

2. Using Hyperledger Fabric (IBM):

- Hyperledger Fabric, a private and permission-based blockchain platform, creates a separate ledger for invoice transactions.

- Multiple channels are established within Hyperledger Fabric to represent different groups of participants, ensuring privacy and access control.

- Smart contracts, or chaincode, are installed and executed on specific channels to manage invoices and duplicate detection rules.

- Transactions are endorsed by relevant participants based on channel policies and added to blocks through a consensus mechanism.

Both Ethereum and Hyperledger Fabric offer advantages in different scenarios. Ethereum is suitable for public use cases with transparency, while Hyperledger Fabric is preferred for private and enterprise solutions with higher privacy and control. The choice of platform depends on the specific requirements of the supply chain finance system.

- **AI Duplicate Detection Model:** An AI/ML model trained on historical invoice data processes the newly submitted invoices. The model compares the extracted data with existing records on the blockchain to identify potential duplicates.

1. **Google's Cloud Natural Language API** is a service that identifies duplicate invoices by comparing the text of invoices to a database of previously processed invoices.

2. **Amazon Comprehend** builds, train, and deploy machine learning models. Companies use it to identify duplicate invoices based on various factors, such as the invoice number, the amount of the invoice, and the date of the invoice.

- **Duplicate Invoice Detection Decision Engine:** The AI model acts as a decision engine, identifying and flagging potential duplicate invoices for further verification.

- **Alerting & Manual Verification:** An alert service is triggered for flagged invoices, notifying the finance team or relevant stakeholders. Manual verification ensures the accuracy of the duplicate identification before taking further actions.

1. If the AI model identifies a potential duplicate, it sends an alert using **Amazon Simple Notification Service (SNS)** to the finance team or relevant stakeholders.

The flagged invoices are subject to manual verification by the finance team to ensure the accuracy of the duplicate identification. Approved invoices proceed for further processing in the SCF process. Rejected invoices may be flagged for resolution or further investigation.

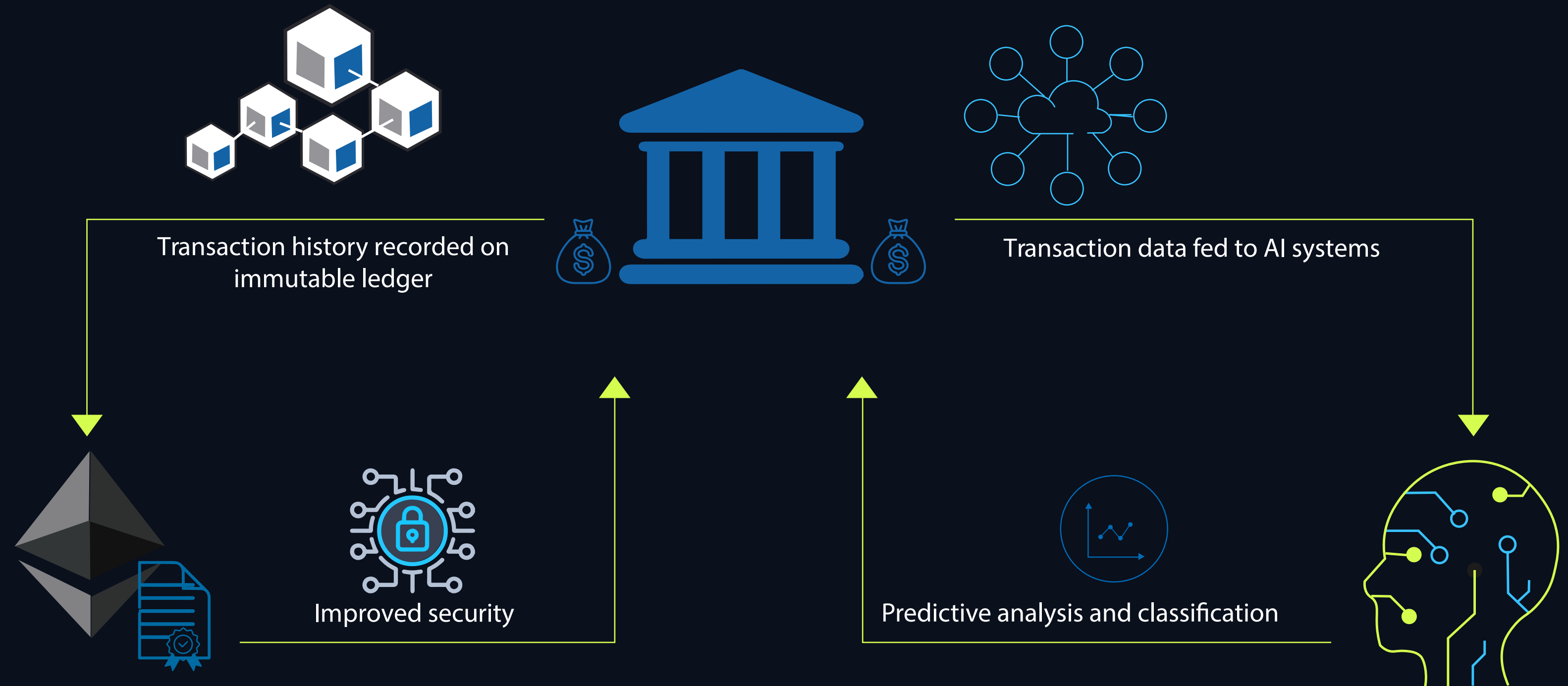
By integrating blockchain and AI in this manner, the solution benefits from blockchain's secure, transparent ledger for recording invoices and AI's pattern recognition capabilities for efficient and accurate duplicate invoice detection.



Power of _____ Hybrid Solution = Blockchain + AI

Blockchain technology is known for its secure and immutable nature, making it ideal for creating transparent and lasting records of transactions. In supply chain finance, it can provide benefits like improved traceability, transparency, and secure transactions. It ensures that once data is recorded on the blockchain, it cannot be altered, providing a single source of truth for all parties involved.

On the other hand, AI excels in data analysis, pattern recognition, and decision-making. It can help identify patterns, detect anomalies, and provide valuable insights from vast amounts of data. Businesses use AI can to enhance invoice processing, detect duplicate invoices, optimize financial operations, and make more informed financial decisions.



Source: IEEE Access - Integration of AI and Blockchain for financial institutes

BLOCKCHAIN	AI	INTEGRATION BENEFITS
Decentralized	Centralized	Enhanced data security
Deterministic	Changing	Improved trust in robotic decisions
Immutable	Probabilistic	Collective decision making
Data integrity	Volatile	Decentralized decisions
Attack resilient	Data knowledge	High efficiency

- **Enhanced Data Security:** Blockchain ensures secure storage of sensitive data with digital signatures and private keys, providing credible outcomes for AI algorithms.
- **Improved Trust on Robotic Decisions:** Recording AI decisions on a blockchain’s decentralized ledger increases transparency and trust, eliminating the need for third-party auditors.
- **Collective Decision Making:** In robotic swarms, voting and majority rules on a public blockchain facilitate coordinated decisions.
- **Decentralized Intelligence:** Combining individual cybersecurity AI agents enables coordinated security and solves scheduling issues.
- **High Efficiency:** Integrating AI and blockchain with Decentralized Autonomous Agents (DAOs) streamlines data and asset transfers among stakeholders.



AI + Blockchain

By combining AI's analytical capabilities with blockchain's security and transparency, businesses can create a more efficient, secure, and data-driven supply chain finance ecosystem.



- **ENHANCED DATA ANALYSIS**

AI can analyze the vast amount of data stored on the blockchain to provide valuable insights and identify trends that can optimize supply chain finance operations.



- **SMART CONTRACT AUTOMATION**

AI can work alongside blockchain's smart contracts to automate and optimize financial processes, ensuring all conditions are met before executing transactions.



- **IMPROVED DECISION -MAKING**

AI can analyze the historical transaction data stored on the blockchain to aid in better financial decision-making, risk assessment, and forecasting.



- **CONTINUOUS LEARNING AND OPTIMIZATION**

AI can continuously learn from new data and transactions on the blockchain, improving its performance over time and adapting to changing conditions.

Instead of perceiving AI and blockchain as competing solutions, they can work in synergy to offer a comprehensive and robust approach to SCF.

By combining AI's analytical capabilities with blockchain's security and transparency, businesses can create a more efficient, secure, and data-driven SCF ecosystem. Utilizing both technologies allows companies to harness the strengths of each and overcome their respective limitations, providing a more comprehensive and robust solution for supply chain finance.

Globant's --- experience

Globant has successfully been working with clients in the SCF space, building and solving flagship products. One such client was a financial institution which provided innovative financial products and services to optimize working capital and improve cash flow for businesses involved in complex supply chains.

Our primary focus was to identify and prevent duplicate invoices to avoid financial losses, maintain accurate records, and preserve the trust between the parties involved in the supply chain.

We provided solutions around AI and machine learning techniques to recognize patterns and score them accordingly. Any score beyond our threshold indicated potential duplicates.

We started with risk analysis scales to assess the likelihood of duplicate invoices and help identify them.

- We found several duplicate records, like unusual document IDs. For instance, where the invoice IDs were in a methodical pattern - GLB1234, GLB3456, GLB6789,

the sudden occurrence of a GLA3546 could raise a red flag, signaling a duplicate.

- Another clue was unusually high expenses on the bills. If our normal range falls between 10K to 20K, but we receive an invoice worth 200K – 20 times higher than usual – this may hint at foul play.
- Finally, variations in vendor names also raised suspicion. For example, receiving invoices from both “GOOGLE” and “Goggle”, or “Apple” and “APLE”.

Risk analysis scales provided a structured approach to quantify the risks associated with each invoice and flag suspicious transactions for further investigation.

- **Data Extraction and Preprocessing:** We extracted the invoice data using OCR technology to obtain relevant information such as vendor name, invoice number, invoice date, and total amount. Preprocessing standardizes and cleans the extracted data for further analysis. The extracted data serves as input for the risk analysis model.
- **Risk Analysis Scales:** These are predefined rating systems that assign scores or levels of risk to different attributes of an invoice.

For example:

- **Vendor Reputation Scale:** Rates the vendor's historical behavior and reliability based on past transactions and payment history.
- **Invoice Amount Deviation Scale:** Assesses the deviation of the invoice amount from the vendor's typical transaction amount.
- **Duplicate Invoice Frequency Scale:** Measures the frequency of duplicate invoices submitted by the same vendor within a given period.
- The scores from different attributes are combined, using weighted averages, to generate an overall risk score for the invoice.
 - **Weighted Scoring:** Each risk analysis scale is assigned a weight based on its significance in duplicate invoice detection. For example, the vendor's reputation may have a higher weight as it can strongly indicate potential duplicity.
 - **Scoring and Threshold:** We apply the risk analysis to the extracted data, and we calculate individual scores for each attribute. The scores are then combined using weighted averaging or another appropriate method to obtain an overall risk score for the invoice.

- **Pattern Recognition Algorithms:** AI is excellent at recognizing patterns in large datasets. AI algorithms analyze historical invoice data for duplicate invoice detection to identify common patterns among genuine and duplicate invoices. These patterns can include repetitive invoice numbers, identical line items, or similar total amounts. By identifying suspicious patterns, the AI system can flag potential duplicates for investigation. Algorithms like Clustering Algorithms (e.g., k-means, hierarchical clustering) helped us to identify these patterns.

- **Combining Risk Score and Pattern Matching:** We combine the risk score obtained from the risk analysis scales and the results from the pattern matching algorithms to make a more informed decision on potential duplicate invoices.

Higher risk scores from the risk analysis scales and close matches from the pattern-matching algorithms contribute to a higher likelihood of duplication.

- **Threshold Determination and Flagging:** We set a threshold value to classify invoices as potential duplicates based on the combined risk score and pattern-matching results.

Invoices with scores above the threshold are flagged for manual review by finance personnel or relevant stakeholders.

- **Manual Verification and Resolution:**

- Flagged invoices undergo manual verification to determine if they are genuine duplicates or if there is a legitimate reason for the similarities.
- Finance personnel investigate further and take appropriate actions, such as contacting the supplier for clarification or resolving discrepancies.

By integrating qualitative pattern matching and quantitative risk assessment, we successfully addressed a problem for our SCF client. This comprehensive approach significantly reduced false positives and enhanced the identification of potential duplicate invoices in the entire process. The synergistic combination of these techniques elevates the overall accuracy and reliability of the duplicate invoice detection system.

Conclusion

In light of these insights, it is evident that tackling duplicate invoicing requires a multifaceted approach that addresses both technical vulnerabilities and human factors. The combined approach of AI and Blockchain provides a reliable, tamper-proof, and efficient way to detect and prevent duplicate invoices in supply chain finance.

By taking proactive measures and investing in robust systems, supply chain stakeholders can build a resilient and efficient ecosystem that withstands the threats posed by duplicate invoicing. Businesses must stay vigilant and continuously adapt their strategies to keep pace with the evolving supply chain finance landscape. Ultimately, an integrated and secure supply chain finance network will protect businesses from financial losses and strengthen their competitive edge, foster collaboration, and propel sustainable growth in the global marketplace.



About Globant:

We are a digitally native company that helps organizations reinvent themselves and unleash their potential. We are the place where innovation, design and engineering meet scale.

- We have more than 27,000 Globers present in 30 countries in 5 continents working for companies like Google, Electronic Arts and Santander, among others.
- We were named a Worldwide Leader in CX Improvement Services by IDC MarketScape report.
- We were also featured as a business case study at Harvard, MIT, and Stanford.
- We are a member of The Green Software Foundation (GSF) and the Cybersecurity Tech Accord.

For more information, visit www.globant.com

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