Transforming Risk Assessment in Insurance and Trade Finance Through InsurTech and Predictive Analytics

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Abstract- ***The synergy of advanced technologies such as artificial intelligence (AI), machine learning (ML), predictive analytics and blockchain is propelling an era of change in the manner insurance underwriting, risk analysis and fraud detection are achieved. This paper reviews the literature on InsurTech and associated innovations with the sole aim of reviewing the scalable solutions that lead to transparency, efficiency and inclusivity in insurance areas as well as in the areas of trade finance. We reveal how big data and AI enable insurers to "predict and prevent", not only "see" risks, thus facilitating personalized pricing, automated underwriting and proactive fraud detection. Likewise, blockchain and digital platforms are transforming trade finance by generating the unalterable, transparent part of transaction history that liquidates the multi-trillion-dollar trade credit gap. We focus on the issue of applications in developed and emerging markets demonstrating that digital channels and microinsurance products reach unaddressed population. Finally, we describe the challenges and potential future research directions for integrating these technologies into the risk management fabric of the financial services sector.***

I. INTRODUCTION

Risk assessment centres around financial services. In insurance, it is common practice to base traditional underwriting on actuarial tables as well as historical claims, whereas in trade finance, reliance is placed on a manual check of letters of credit and guarantees. Nevertheless, modern world of global finance requires such dynamic approaches. In 2022 the global insurance industry wrote approximately US$6 trillion in premiums (a number higher than Japanese GDP) and the trade finance gap (the difference of demand for finance and supply) hit record level of US$2.5 trillion (Ellili et al., 2023). This shortfall weighs unfairly on small and medium size enterprises (SMEs) – 38% of SME trade finance applications were rejected in 2022, which goes to show the need for an innovation.

AKA InsurTech, newly emerging technologies are set to revolutionize how we structure risks and spot fraud – predictive analytics powered by AI, IoT/telematics, and blockchain. InsurTech, "insurance companies, intermediaries or value-chain specialists utilising technology to compete or add value", has been adopted rapidly around the world. These tools allow insurers to process huge new sources of raw data (from social media, sensor data, satellite imagery etc.); to develop flexible products (usage-based policies, on-demand coverage) tailored to previously underserved customers cost-effectively (Smit, Denoon-Stevens, & Esser, 2017; Amnas, Raja, & Velmurugan, 2025). In trade finance, blockchain, a form of distributed ledger technology (DLT), develops a single source of truth for the transactions thus eliminating duplication and fraud (Kellaf, 2024; OECD, 2021).

This paper analyses the transformative effect of these technologies on the risk management. We review scholar and industry literature, recent quantitative studies and market data to demonstrate how InsurTech and predictive analytics are enhancing transparency and efficiency. Special emphasis is placed on scalable solutions and growth markets: for instance, it is through microinsurance products deployed via mobile apps that barriers to coverage are being reduced for low-income populations (Smit et al., 2017 Cheston et al., 2018). We also consider methodical approaches: our synthesis employs a systematic review methodology (as in Ellili et al. (2023) in order to enable wide representation of relevant research. The results show that despite the fact that challenges (data privacy, legacy systems, regulatory barriers) exist, the resulting effect of these innovations is that risk assessment is faster, more precise, and more comprehensive.

II. METHODOLOGY

This paper uses a systematic literature review approach to assimilate the results of insights on InsurTech and predictive analytics to risk management. Through keyword searches (“insurtech”, “predictive analytics”, “blockchain trade finance”, etc.) in databases and Google Scholar we found more than 50 recent sources (academic articles, industry reports, and white papers). Our guidelines applied for a comprehensive review: for instance, Ellili et al. (2023) have based their approach on bibliometric and systematic approaches that allocate big data usage in insurance (Ellili et al. 2023). Likewise, we grouped findings by theme (underwriting, fraud, blockchain, inclusion) and made critical comparison of results among studies. Data and statistics from the real world (e.g. trade finance gap figures from Future of Trade 2024 , investment levels from IFC) were brought in to situate the analysis (OEDC, 2021; Holliday, 2019). Although there were no primary data generated, there is a structured review integrating both quantitative data (survey percentages; performance improvements) with qualitative observations from the field reports to provide a coherent report of current trends.

InsurTech and Predictive Analytics in Insurance

InsurTech is defined as the usage of digital technologies to all components of the insurance value chain (Smit et al., 2017); Amnas et al., 2025). The insurers are automating processes (processes of claims processing, underwriting) and establishing new products by utilizing AI, machine learning, new data sources, and cloud platforms. For instance, according to Cenfri (2017) new digital techs “promise to reach more low-income individuals cost-effectively, and deliver more customer value”. According to this, Kumar et al. (2025) state that InsurTech “combines insurance with emerging technologies including AI, ML, blockchain and big data to streamline operations, improve customer service, and simplify risk evaluation and pricing models (Amnas et al., 2025).” Such innovations enable such companies to provide “more customized and accessible products”, while simplifying back-end business processes (Smit et al., 2017; IMA, 2021). Amnas et al., 2025).

One of the important components is Predictive analytics. This requires the use of statistical and ML approaches to make sense of historical data to identify patterns that predict future outcomes. One of the reviews put it this way, that predictive analytics “anticipates unknown future events by discerning patterns observed in historical data” through use of the tools from data mining, AI, and machine learning (Jamarani et al., 2024). In insurance, that would be switching from reactive “understand and protect” risk models to proactive “predict and prevent” models (Kajwang, 2022). For example, Kajwang (2022) reports that top insurers applying advanced data analytics have had underwriting transformed fundamentally: digitized claims processes together with big data enable transitioning from the simple evaluation of past risk to identifying future risk tendencies (Kajwang, 2022). The same study observes these tools “make it possible for the role of insurance to transition from ‘understand and protect’ to ‘predict and prevent”(Kajwang, 2022).

Industry surveys corroborate these benefits. In a 2018 Willis Towers Watson survey of life insurers, 67% of companies with predictive analytics had lower expenses and 60% had increased sales (Willis Towers Watson, 2018). The survey also forecast massive increases of data sources use (e.g. 150-170% growth in using clickstream and social media data), goals for AI (e. g. 543% planned raise in detection of fraud patterns, 471% in automated underwriting) (Willis Towers Watson 2018). These findings suggest that insurers trust that machine learning and AI can radically increase efficiency and risk segmentation.

Underwriting and Risk Pricing

Under writing is changing because of AI/ML-enabled predictive models. Algorithms that evaluate risks of all sorts (beyond the actuarial tables of yore) are fed by huge data sets (credit history, telematics, IoT, demographics). For instance, Yeddula (2025) reports that in underwriting application of AI made the risk assessment accuracy increase by 43%, and processing time for complex policies decrease by 31% (Yeddula, 2025). In the lines of business in the commercial sector, the AI system can process thousands of features (structural data, the environmental parameters, historical claims) at once resulting in better underwriting decisions (Yeddula, 2025). According to Yeddula, citing IEEE research he presents 67% fewer manual processing steps and 78% improvement in

fraud detection in AI-based underwriting (Yeddula, 2025). These astounding efficiency gains reduced days of analysis to near-instant decision making therefore bringing out AI's prospects of streamlining risk evaluation.

Dynamic pricing is also made possible by predictive analytics. Insurers employ telematics and Internet of things devices in measuring usage and behavior in real time. Usage-based insurance (UBI) – which is especially popular in auto lines – tracks driving behaviors and levies premiums by mile or metric of risk. The World Bank notes that insurance companies are now able to provide "insurance for shorter periods, such as a month versus a year" through the use of AI and remote sensors making products cheaper and more flexible (Holliday, 2019). Swiss Re reports that big data analytics allow the division of the market into micro sections, with tailored underwriting, that is, customizing the rates to individual risk profile (Holliday, 2019). These predictive techniques reduce adverse selection and moral hazard by correlating risk and pricing together in a combination.

Fraud Detection

Fraud is one great cost in the insurance. Anomalous claims and applications are being detected more and more using machine learning models. Aslam et al. (2022) present a model that is practically relevant: Applying supervised models (logistic regression, SVM, naïve Bayes) to the auto insurance data, they accomplished the high accuracy of fraudulant claim detection (Aslam et al., 2022). The study found that the indicators for fraud are faults-related characteristics and age of the policyholders as the highest indicators demonstrating how AI is able to detect subtle patterns that may go unrecognised by the human eye. Generally, insurers say that ML tools have greatly improved fraud detection: according to one industry analysis there was a 78% increase in fraud-spotting capability post AI deployment (Yeddula, 2025). Such systems will be able to keep learning from new fraud cases, which will adjust to changing schemes.

Blockchain is also useful in fighting fraud in insurance. If insurers record policy contracts and claims in an immutable ledger, falsified documents will no longer exist, and transparency will be ensured. In health and auto lines, prototype systems apply blockchain as a stamp to claims and validate identities, eliminating duplicate or tampered claims. For instance, work in IEEE delves into blockchain-based frameworks for health insurance claims verification – safeguarding data in a transparent, tam-per-proof manner is. Although currently emerging, these studies indicate that the application of blockchain in prevention of fraud supports AI detection, by following the provenance of data from the moment the latter is populated (Kellaf, 2024).

Inclusivity and Emerging Markets

Financial inclusion is one of the great promises of InsurTech. The rate of penetration of the traditional insurance is low in most developing parts of the world. Insurtech solutions can close this protection gap by reducing the cost of distribution and customizing products. The IFC observes that in emerging markets there is a vast "protection gap": e.g In sub-Saharan Africa, less than 3% of risk is insured (Holliday 2019). Digital platforms can make it easy to reach rural and low income clients without the need for physical agents. For example, mobile application enables up the customers to sign up and make payments for microinsurance (small-premium, and small-coverage policies) directly from their phones. Holliday (2019) notes that technology can allow for "bite-sized" insurance on demand: an individual insurance for one bicycle trip or one-month coverage, which is cheaper to people that are not on a stable income (Holliday, 2019). Often, these on-demand products will use algorithms and mobile data to underwrite policies both instantaneously, and on the smaller, short term policy amount.

Empirical examples abound. Discovery's Vitality program in South Africa pays into health/life insurance through use of wearable fitness componentDidMount trackers in premium denials, and the healthy flavors will receive premium discounts (Holliday, 2019). In India, microinsurance is being distributed by InsurTech startups through partnership with telecom and financial tech firms. Kumar et al. write that such startups service rural and rural

emerging middle class markets with simplified insurance products over mobile channels (Amnas, Raja, & Velmurugan, 2025). The Center for Financial Inclusion emphasizes that the use of digital channels and innovations in InsurTech are central strategies for touch base with low-income customers (Cheston et al., 2018).

In the digital innovation of trade finance, inclusivity is also enhanced. The SMEs in developing countries have traditionally found credit to be hard to obtain due to lack of collateral or information. Digital trade platforms and alternative data can change that. For instance, open banking APIs (banking-as-a -service) enable small exporters to submit electronically trade documents and financial statements to lenders enabling building a digital credit profile (OECD, 2021). According to OECD APIs that allow banks to share data with clients in real time and thus help small businesses to be transparent (OECD, 2021). Such platforms, when they are all matched up with the AI credit-scoring models, can now underwrite smaller transactions which were before unworkable. Overall, digital systems promise to lower the perceived risk (of SMEs lending), thus closing the trade finance gap which undermines inclusion (OECD, 2021).

Risk Analysis in Trade Finance (Blockchain and Digital Platforms)

The inefficiencies and risk in the trade finance part have been a long standing problem. Such traditional processes are highly dependent on paper work and manual verification of such multiple counterparties (importers, exporters, banks, carriers) leading to delays, errors and fraud. Trade transaction through Trade finance can be transformed through the use of Distributed Ledger Technology (DLT), such as Blockchain which has a single immutable ledger for trade transactions. A recent review by OECD describes DLT "can create trust between parties that do not know each other as well as trust in data and documentation" (OECD, 2021). Specifically, DLT enables: Certification of provenance of digital documents, assurance of authenticity of bills of lading and letters of credit (1) (Kellaf, 2024), trust in trade transactions through shared ledgers (2) (OECD, 2021), and digital identity management for KYC compliance (OECD, 2021) and implementation of contracts (3) automating execution of contracts through smart contracts (self-executing code for payments/deliveries) (4) (OECD, 2021).

The fraud can be stopped by security features of blockchain. The original design of Nakamoto – blocks hashed and chained by consensus – means that tampering with clauses of past records would be next to impossible (Kellaf, 2024). For instance, Kellaf (2024) notes that in any blockchain, each trade transaction is encrypted and time stamped across a peer network so the data is tamper proof and visible to only authorized members, "which 'reduces the potential for fraud and collusion'" (Kellaf, 2024). In practice, such initiatives as CargoX (blockchain bill of lading on Ethereum) and we.Trade have demonstrated that it is possible to exchange shipping documents digitally in a secure form which has radically shortened processing time and paper delay. These systems also log access activities of all, so an unauthorized change attempt would be clear.

Others ways beyond document security include blockchain to support workflow efficiency. Contour and Komgo – global networks of bank supported trade finance – have connected platforms on which the whole letters of credits transaction can happen within days and not weeks. As an HSBC executive, observed, facilitation of "the instant flow of trusted data across the world's trade routes and fragmented ecosystems" is key to streamlining trade (Trade Insights, 2019. Digital platforms eliminate the need to retyped data; for instance, one OECD report demonstrates how banking APIs enable clients to check bank guarantee status in real time thus eliminating needs for email query (OECD, 2021). In short, blockchain and related technologies directly target traditional bottlenecks: they lock up documents, communicate without interruptions, and roll the process of verifications, which reduces operational and credit risk.

Fraud Prevention and Transparency

Fraud and opacity are two significant dangers in insurance and trade. As identified, AI models scan insurance data to identify anomalous claims (ensuring internal fraud capture) and blockchain validates

external documents (ensuring external fraud capture). In trade, DLT-enabled systems address "classic" fraud schemes: Fake letters of credit, or double-financing. By keeping a single register of all financial records banks can at once check whether a receivable or cargo has been previously financed in another location (OECD, 2021). The OECD suggests that increased visibility of data (a blockchain-based track record of transactions) can "help to reduce the number of rejected financing proposals" because such a book can increase lenders' confidence in SME borrowers (OECD, 2021). Transparency as such is a deterrent.

Blockchain applications are coming up for insurers in claims processing. Researchers have suggested platforms where health or auto insurance claims are written on-chain. Validators (insurers and regulators) can then check every claim's authenticity before payout. Such solutions reflect how credit reporting agencies prevent loan fraud: only true claims are repaid. Some of the early pilots (e.g. IBM's blockchain insurance prototype), have proven having lower incidences of fraud than the traditional channels. Though these systems are currently nascent, their literature implies that blockchain will complement AI fraud detection by ensuring the security of the claims pipeline all the way through.

III. DISCUSSION

Enhancing Transparency and Efficiency

Digital innovations constantly provokes increase levels of transparency and efficiency of financial risk flows according to reviewed literature. In the world of Insurance AI-induced processes take over manual work. For example by automating the intake of underwriting data, insurers can underwrite policies within minutes, not days, and retain or even improve accuracy (Yeddula, 2025). Claims processing becomes faster when pre-validation of routine claims by AI bots is carried out and exceptions are flagged. Multiple sources report cost savings: one study refers to (Willis Towers Watson, 2018; Yeddula, 2025) insurer reductions of up to two-thirds in processing workload and significant loss ratios buts. Also based on integrations of data, efficiency gains are obtained: big data platforms aggregate customer and sensor data thus enabling cross functional teams to work together.

In trade finance, the "paper-chase" between exporters, importers, banks and customs falls in the digital platform. The OECD states that billions of savings (USD 2.5–6 billion) are realizable with digitization of procedures in trade (OECD, 2021). For instance, during the companies such as Garanta, BNP and others ECAs have digitized guarantees thus reducing the time taken to issue and amend guarantees from days to minutes. The same is true of the PDF documents/stamps that constitute relevant records – they can be represented through blockchain plug-and-play digital tokens. In one blockchain network a letter of credit issuance time fell from several days to less than an hour in pilot tests. Such transformations demonstrate how transparency (on shared ledgers and APIs) drastically reduces process latency and reduces human error.

Improving Risk Assessment and Pricing

The volume of data today makes it possible to engage in risk assessment that is a bit more subtle. Insurers can use social determinants, real-time environmental data and user behavior to improve pricing. For example, usage-based policies in auto and health ensure a premium based on individual actions (mileage; driving style and fitness levels) (Holliday, 2019). This customization can eliminate the occurrence of adverse selection: Safe drivers pay less, and high-risk individuals no longer pay them exorbitantly. Further, insurers are taking to predictive models that predict not simply the level of risk but also risk changes. For instance, AI could detect a latent risk trend in advance of a claim (e.g deteriorating driving patterns, or increasing health metrics) and engage before the event (e.g. via wellness coaching, driver alerts).

Trade finance risk modeling is also becoming. Before, credit-granting decisions by a small exporter were based on abridged financial statements or collateral; today AI can analyze alternative data (e.g . shipping histories, supply chain reputations, invoice patterns) to deliver better credit score results. ML-based credit models could approve hundreds of millions in trade

transactions that traditional scoring would reject based on one trade-fintech report estimate. When linked with the blockchain's proof of provenance the lenders will have increased credit to collateral, (generally goods or receivables). This synergy is particularly promising for emerging markets where credit histories of formal credit are lacking.

Fostering Inclusion in Established and Developing Markets

The reviewed evidence highlights the inclusive potential of the technologies under studies. In mature markets, the convenience and satisfaction from InsurTech (e.g. instant quotes, app-based services) increases. But its effect is likely to be more profound in frontier markets. As Cheston (2018) observes, it is necessary to offer base-of-pyramid customers line of products at a reasonable and simple cost (Cheston et al., 2018). Digital insurance platforms are just this: policyholders have the option of registering on mobile applications or through USSD codes with no complicated paperwork or inconvenience of travel (Cheston et al., 2018). Parametric insurance (which pays out on predetermined triggers such as rainfall indexes) is usually delivered through the digital medium thus, farmers can hedge weather risk without claims adjudication.

Trade innovations likewise expand reach. Digital trade platforms minimise dependency on physical bank branches. For instance, a small manufacturer in Kenya can upload shipment invoices to a platform which automatically informs the banks and the credit insurers. Transparency in a blockchain record can persuade creditors that a shipment does exist thus encouraging them to continue funding. Digital trade networks for Asian markets already register high SME involvement: in 2019, one Chinese bank platform facilitated SME trade transactions valued at over US$56 billion (Trade Insights, 2019). Such a scale suggests that even the classic "unbanked" traders can be brought into the global financial system using digital instruments.

IV. CHALLENGES AND FUTURE DIRECTIONS

But progress has not eroded recent expectations. Quality of data and privacy become the major concerns. AI and analytics are bargains only on data thrown at them. Flawed risk scores may result from wrong or biased input data. For instance, the OECD warns that since the blockchain's immutability means that "erroneous data… cannot be revised" (OECD, 2021), the data within the framework is immutable. Therefore, systems need data-verification procedures (such as GPS verification of cargo, anti-tampering sensors) and ensure personal data is protected. GDPR etc. also regulate the way that insurance companies can use sensitive data (biometrics, social media). Finding a fine-grained balance between data richness and customer privacy will require good policy and technological design (for example differential privacy, federated learning).

To another issue, interoperability and standards. There are many any competing platforms (Contour, we.Trade, Komgo on trade; Different APIs in insurance but with no common standards, networks suffer limited reach. Before it can be truly scalable, standard protocols and regulatory harmonization are needed (OECD, 2021), OECD and industry bodies emphasize. Likewise, InsurTech innovations find themselves coming up against the legacy insurance regulation (capital requirements, licensing) which were not designed for an on demand or a parametric model. The regulators and insurer needs to work together to freshen up these frameworks.

Finally, for inclusivity education and trust building is required. Customers, especially in rural areas, need trust of the digital products. This could be with trusted local agents, or even NGOs. Also, financial literacy is key: Even a sleek app will not help one person who does not understand what insurance is for. The literature suggests the integration of technology and community outreach to realize real inclusion.

CONCLUSION

New technologies are radically transforming risk analysis in insurance and trade financings. AI and

predictive analytics allow insurers and banks to do deep analysis of vast new data sets, resulting in better underwriting, individualized policies, and more timely-rather than post hoc detection of fraud (Yeddula, 2025; Aslam et al., 2022). Blockchain and APIs are automating transactions among institutions, removing opacity in which enhances trust and effectiveness (Kellaf, 2024; OECD, 2021). Such innovations are not only beneficial for mature markets. they have great promise for the developing world by increasing the reach of finance and insurance. To make policies affordable (e.g. mobile microinsurance) while making trade credit available (through shared digitized records), technology can fuel the eradication of historic protection gaps (Smit et al. 2017; OEDC, 2021).

That said, and to reap these benefits, they should be implemented carefully. Data governance, cross border standards and digital literacy must be tackled to prevent emergence of new types of exclusions. Future work should operationalise the effects of specific technologies (how much fraud is stopped by a specific AI tool, or how much extra credit is unlocked via a blockchain trade platform). Policymakers and industry leaders too will have to keep revising regulatory frameworks instead for them to still remain relevant with the pace of advancement.

In short, the evidence points to potential for transformation: Risks can only be more and more controlled via prediction and not reaction and cooperation (in terms of shared ledgers) can now back the transactions that before seemed too obscured. As InsurTech and predictive analytics diffuse further they have the potential to create more transparency, efficiency, and inclusion into insurance and trade finance for all participants, from rural farmers to global supply chains.

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