IV. DIGITAL DILEMMAS: HOW EMERGING TECHNOLOGIES ARE SHAPING THE FUTURE OF INSOLVENCY AND BANKRUPTCY

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ABSTRACT

The advent of technological advancements in Artificial Intelligence (AI), Machine Learning (ML), Big Data, and Blockchain are profoundly transforming the legal and regulatory landscapes. This research paper delves into the significant opportunities and challenges that these disruptive technologies introduce into the domains of insolvency, bankruptcy, and restructuring on an international scale.

The paper begins by offering a detailed taxonomy of emerging technologies relevant to insolvency, categorizing them into five distinct segments. This taxonomy is technology non-neutral and focuses particularly on the 'type' of technologies used. This structured approach serves as a foundation for a comprehensive analysis on how each technology can enhance the efficiency and effectiveness of insolvency practitioners (IPs), resolution professionals (RPs), and adjudicating authorities. Thereafter, the paper proceeds to address the myriad challenges that accompany these technological advancements. These include the risks of automation bias, issues with the translation of laws into rule based codes by programmers and treatment of diverse data as an asset, and the complexities associated with defining, recognising and managing cryptocurrencies as assets within the insolvency estate (or outside it). Each challenge is examined with a view to understand their implications for current insolvency practices and the broader legal framework.

In response to these challenges, the paper proposes a set of regulatory strategies designed to effectively govern the integration of emerging technologies within insolvency regimes. Emphasizing a 'new functionality, new rules' approach, it argues for the creation of adaptive regulatory frameworks that can evolve in tandem with technological advancements. This approach aims to harness the benefits of innovation while mitigating potential risks. In broader strokes, this paper illuminates the expansive possibilities that modern technologies have to offer for enhancing insolvency practices worldwide. It also urges regulators to adopt a proactive stance in addressing the challenges posed by these technologies, ensuring that the regulatory environment remains robust, flexible, and conducive to positive change. Through its nuanced analysis and forward-looking recommendations, the paper provides a roadmap for navigating the intersection of technology and insolvency in the 21st century.

Keywords: Artificial Intelligence, Insolvency, Bankruptcy Prediction, Blockchain, Digitization

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I. INTRODUCTION

We are in the midst of full-scale techno-social revolution today – the epicentre of which is 'Artificial Intelligence'. Artificial intelligence, much like mobile phones and the internet, is poised to not only make our lives more efficient but also change the social and economic edifice of the society. AI along with other emerging technologies like blockchain, big data, cloud computing and predictive analytics today have pervaded all disciplines. A particularly profound impact has been observed in the fields of finance and law through emerging technologies such as 'Fintech[1],

[1] Fi Bernardo Nicoletti, 'The future of Fintech: Integrating finance and technology in financial services' [2020] Springer; Di Pietro, F.: Deciphering crowdfunding. In: Lynn, T., Mooney, J.G., Rosati, P., Cummins, M. (eds.) *Disrupting Finance.* PSDBET, (Springer, Cham 2019).; B Financial Innovation Network, Artificial Intelligence and Machine Learning in Financial Services - Market Developments and Financial Stability Implications, https://perma.cc/K348-89EA, accessed 3 March 2024.

Blockchain[2] and 'RegTech'.[3] Particularly in finance, these technologies allow resources to be efficiently re-allocated across the world at the speed of light.[4] On the other hand, a litany of scholars such as Kenneth Bamberger[5], Frank Pasquale.[6] Deans Keats Citron[7] and Christophe K. Odinet[8] highlight the problematic characteristics of this technological revolution such as large scale 'automation bias', 'Algorithmic discrimination', 'use of Black Box Algorithms', 'Data Privacy concerns' and 'a crises of due process' as reasons to espouse concern in technological advancements through automation in finance and law.[9]

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[2] Kakavand, Hossein, Nicolette Kost De Sevres and Bart Chilton. "The Blockchain Revolution: An Analysis of Regulation and Technology Related to Distributed Ledger Technologies." *IRPN:* Innovation & Cyberlaw & Policy (2017) https://perma.cc/K348-89EA, accessed 3March 2024; Tanwar, Sudeep. "Blockchain revolution from 1.0 to 5.0: technological perspective." In Blockchain Technology: From Theory to Practice, (2022) Springer Nature Singapore; Fenwick, Mark, Wulf A. Kaal, and Erik PM Vermeulen. "Legal education in the Blockchain revolution." Vand. J. Ent. & Tech. *L.* 20 (2017): 351.

[3] See for example, Vicki Waye, 'Regtech: A New Frontier in Legal Scholarship' (2019) 40 Adel L Rev 363; Buckley, R.P., Arner, D.W., Zetzsche, D.A. *et al.* The road to RegTech: the (astonishing) example of the European Union. *J Bank Regul* 21, 26–36 (2020); Armstrong, P. (2018). Developments in RegTech and SupTech. *Paris: Paris Dauphine University.* Arner, D. W., Barberis, J., & Buckey, R. P. (2016). FinTech, RegTech, and the reconceptualization of *Nw. J. Int'l L. & Bus.*, *37*, 37; Arner, D. W., D. A., R. P., & Weber, R. H. (2020). The Future of Data-Driven Finance and Regtech: Lesson from EU Big Bang II. *Stan. JL Bus. & Fin.*, *25*, 245; Barberis, J., Arner, (2019) D. W., & Buckley, R. P. *The REGTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries in Regulation*. John Wiley & Sons; Narang, S, (2020). Accelerating Financial Innovation through Regtech: A new wave of fintech. In*Fostering Innovation and Competitiveness with FinTech, RegTech, and SupTech* (pp. 61-79). IGI Global.

[4] ibid at 96

[5] Bamberger, Kenneth A. "Technologies of compliance: Risk and regulation in a digital age." *Tex. L. Rev.* 88 (2009): 669.

[6] Frank Pasquale, *The black box society: The secret algorithms that control money and information* (Harvard University Press 2015).

[7] Citron, Danielle Keats. "Technological due Process" (2008) 85 Wash. UL Rev.

[8] Odinet, Christopher K., Fintech Credit and the Financial Risk of AI. in Kristin Johnson & Carla Reyes (eds), *Cambridge Handbook of AI and Law* (Cambridge University Press 2024).

[9] See for example a previous writing of the author on this subject Jain, Aditya Sushant. "An inter-disciplinary approach to automation technology in finance-what can history, law and data science teach us?." *ICTACT Journal on Soft Computing*14, no. 01 (2023): 3154-3164.

The discipline of Insolvency is no exception to this technological revolution. In the words of another scholar, Insolvency practices today are undergoing a 'digital disruption.'[10] Insolvency and bankruptcy laws are 'economic legislations' that help company's restructure in the event of bankruptcy and provides critical palliative care so as to revive them, as a last resort, they provide an orderly and systematic liquidation proceeding so as to prevent the tragedy of commons during the sale of assets by balancing the interests of various creditors and stakeholder, and further insolvency law ensures value maximation of assets thus ultimately benefitting the economy tremendously. More importantly, Insolvency law helps to free up stuck assets and quickly put them to better use and hence they prevent the opportunity cost an economy suffers due to 'idling of assets'. Insolvency and bankruptcy regimes today however suffer from various systematic problems – information asymmetry, litigatory delays, red-tapism, lack of an extensive market for stressed assets, overwhelming documents, data sets etc. Scholars thus argue that emerging technologies such as risk predicting models, Technologically Aided Review (TAR), Blockchain and smart contracts, big data and cloud storage could potentially solve all of such problems and are even being hailed so far as catalysts for a metamorphosis in insolvency and restructuring practices.[11] However, there adoption comes with its own challenges. A 2019 study by Insol International found that while most insolvency professionals agreed technology would be central to their future work, its adoption remained low.[12] Akshay Kamalanatha attributes this to two factors: a lack of training and technological skills among professionals, and

[10] Trakman and Walters, Contemporary issued in Finance and Insolvency (Taylor and Francis 2023).
[11] Toms and Colston, 'The role of Artificial Intelligence and technology in Global Bankruptcy and restructuring practises', Insol International Special Report (2019).
[12] Jane Colston, Christian Toms, 'The Role of Artificial Intelligence (AI) and Technology in Global Bankruptcy and Restructuring Practices' (2019) Insol International.

the cost-effectiveness concerns of smaller firms. Similarly, a survey by Jennifer Dickfos showed that insolvency professionals were often unprepared or unaware of technological advancements. She also points to the "AI Fallacy" by Susskind & Susskind, which suggests that many believe AI cannot replace human reasoning in insolvency work.[13]

As *insolvency practices* are in the process of a gradual revolution, at the same time however, due to the rapid technological changes in economies and the creation of new asset classes such as 'crypto' and 'data', *insolvency laws* across the globe are being criticized for not being able to 'keep up'. Hence, the two most important questions that insolvency scholars must engage with today are (a) how we can automate, innovate and streamline the insolvency and restructuring practices globally through technology and (b) how we can 'update' and modernize insolvency laws, so that they are ready to deal with the challenges of tomorrow which arise from the creation of digital economies and new 'technological' asset classes. The goal of this paper is thus to locate the discipline of insolvency and bankruptcy within the *global tech discourse* and convey to the reader a nuanced analysis of firstly, opportunities that technology today offers for us to innovate and automate insolvency practices and secondly concerns engendering from the impact of AI and allied technologies to the field of insolvency and bankruptcy, showcasing and urgent need to update insolvency laws so as to prevent them from becoming anti-quated.

Hence, in broader strokes this paper shall analyze two focal questions: firstly, how can *insolvency practices* innovate and update using technology and what opportunities can be exploited for the same and secondly how *insolvency laws* can update and innovate themselves to keep up with rapid

[13] Richard Susskind and Daniel Susskind, *The Future of the Professions: How Technology Will Transform the Work of Human Experts* (1st edn OUP, 2015).

technological advancements and creation of new digital assets. For that purpose, section I provides a brief introduction to the subject matter of this paper, Section II aims to create a taxonomy for insolvency technology by harmonizing the opportunities and risks, Section III analyses the 5 different kinds of technological disruptions in insolvency namely (a) Artificial intelligence in bankruptcy prediction; (b) Big data, data analysis and cloud computing, (c) Blockchain technology (d) RegTech and LLM's & (e) process reforms through automation. Section IV then scrutinizes these five technological disruptions and showcases the critical risks and threats that they pose insolvency regimes. Section V then concludes.

II. TOWARDS CREATING A TAXONOMY FOR INSOLVENCY TECHNOLOGY

In the past there have been scant attempts by scholars to postulate a 'taxonomy' for classifying innovative technologies in insolvency technology. Creating a taxonomy or in the very least a conceptual categorization of various kinds of technological disruptions in insolvency and restructuring practices is important to realize both the opportunities and the broader risks posed by such innovations. While significant attempts have been made to create 'fintech' taxonomies such as by Imerman and Fabozzi[14] & Ratecka,[15] a taxonomy for insolvency resolution technologies remain peculiarly absent – perhaps due to its inceptive nature. Through this paper, I aim to create a taxonomy of 'technological disruptions' in insolvency that can be of assistance to both insolvency practitioners in terms of ascertaining the opportunities as well as to regulators for ascertaining risks. The earliest attempt at creating a taxonomy

[14] M.B. Imerman and F. Fabozzi, "Cashin in on Innovation: A Taxonomy of Fintech" (2020) 21 Journal of Asset Management 167.
[15] P. Ratecka, "Fintech-Definition, Taxonomy and Historical Approach", (2020) 45 MSE in Tarnow Research Papers Collection 55.

for technological innovations in insolvency was by Jennifer Dickfos in 2018[16]. Jennifer used Susskind and Susskind's model and divided technological innovations in insolvencies under either automation or innovation. She classified RegTech and opportunities opened by cloud computing under 'automation', and predictive technologies as under 'innovation'.[17] Her work was taken forward later by Loiacano and Rulli who in their paper 'ResTech: Innovative technologies for crisis resolution' postulated another unique taxonomy for resolution technologies called 'ResTech'[18] partly inspired by 'FinTech' and 'RegTech'. Loiacano and Rulli thus created four functional areas of ResTech:

- Technology that supports resolution planning activities.
- Technologies that support execution of resolution actions.
- Technology that supports cross border insolvencies.
- Technologies that assist financial firms in compliance with resolution authorities.

Building on the work for Loiacano and Rulli, I posit a fivefold model of ResTech where I classify five different kinds of broad and umbrella technological disruptions currently revolutionising insolvency practices across the world:

- **Bankruptcy Prediction Technology**: Comprising of Machine learning modes, Deep/and Neural Networking models that predict the risk of bankruptcy and flag red alerts before a company goes insolvent.
- **Big Data Analytics:** Use of AI, and Big Data analytics as an allied technology to analyse vast amount of documents and synthesise and store data

[16] Dickfos, Jennifer. "AI and the Insolvency Profession: The State of Play."2018 (4) INSOLVENCY LAW JOURNAL 172.
[17] ibid.
[18] Loiacono, G., Rulli, 'E. Restech: Innovative Technologies for Crisis Resolution' (2022) 23 J Bank Regul, 227.

on online cloud servers. These can be used to categorize, analyse and filter huge sets of financial and miscellaneous documents during insolvency.

- **Block Chain & Distributed ledger:** These technologies store information on distributed ledgers and automatically verifies it. These technologies reduce information asymmetry and increase security. They can help in asset tokenization during asset sale, help in voting for the Committee of creditors ('**COC**') especially for large scale insolvency where creditors are enumerable etc.
- **LLM's and RegTech:** These technologies use rule based algorithms to automate compliance with laws and offer solutions that mimic human linguistic logic and reasoning. These can offer advisory services to resolution professionals ('**RP**') and analyse contracts and laws.
- **Technology assisted Process reforms**: These include simple automation and streamlining of insolvency procedures using non-sophisticated technology.

These technologies in cumulation have produced various services and products such as, Bankruptcy prediction softwares TAR (technologically aided review), ROSS intelligence, Blockchain Tokenization, cloud data storage etc. that are today re-shaping insolvencies by reducing information asymmetries, automating contract review, managing data and advising RPs. At the same time however, these technologies present significant risks particularly with respect to how insolvency laws should respond to new digital assets created by such technologies. The next section shall provide a detailed analysis towards how these technologies are shaping insolvency practises or could shape insolvency and restructuring practices in the future.

III. OPPORTUNITIES AND POTENTIAL FOR INSOLVENCY AND RESTRUCTURINGS

This chapter shall highlight the multifarious opportunities and potential that emerging technologies present to insolvency and restructuring practises worldwide. The section follows the 5-fold technological taxonomy created in section II and showcases the current technological developments and potential developments in insolvency practises globally.

A. Bankruptcy Prediction Technology

The insolvency and restructuring process starts even before bankruptcy of a firm is declared. The EU directive 2019/1023 on Preventative Restructuring framework and EU (Preventative Restructuring regulations) 2022[19] introduces the concept of 'early warning mechanisms' designed to warn directors of pending insolvency. A number of jurisdictions today have introduced the idea that companies and banks should enter into insolvency not when they fail but when they are likely to fail.[20] India has also recently introduced the concept of Early Warning System limited to fraud detection in banks with the help of Artificial Intelligence.[21] It is precisely at this juncture that bankruptcy prediction technologies, and the accuracy with which they can make predictions, can come in handy. Bankruptcy prediction technology utilises probabilistic modelling, data visualisation and machine learning techniques to ascertain solvency of a firm. Bankruptcy prediction software have a fascinating history, which is inter-twined with the history of financial ratios. Their journey starts from the path setting work of Beaver and Altman.

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[19] Directive (EC) on preventive restructuring frameworks, on discharge of debt and disqualifications, and on measures to increase the efficiency of procedures concerning restructuring, insolvency and discharge of debt, and amending Directive (EU) 2017/1132 (Restructuring and Insolvency Directive), OJ L 172.

[20] n 16.

[21] Reserve Bank of India 'Master Directions on Fraud Risk Management in Commercial Banks (including Regional Rural Banks) and All India Financial Institutions' (2024).

Beaver conducted a univariate analysis of 30 financial ratios from 79 pairs of companies. He found out that working capital/debt ratio followed by net income/total assets ratios were the best determinants of solvency. Beaver's research focused on univariate analysis however, he highlighted the importance of multi-variate analysis in risk predictions by highlighting that multiple ratios considered simultaneously may have a higher predictive ability that single ratios. Univariate means that response variable are influenced by only one factor whereas multivariate means it is influenced by multiple factors. Beaver suggested that multiple ratios considered together may have a higher predictability than single ratios. This axiom was then put to action by Altman in 1968 with his Z-Score model which was the first multi-variate model. Post, which, various alternatives of multivariate technologies started to be used such as logistic regression, Logit and probit regression. The complexity of such models reached its peak when neural networking models based on deep learning and back propagation started to be used. These models are self-learning and extremely accurate however the downside is their 'black box' nature as will be explained in the Section IV. Artificial neural networks use highly complex nodal relationships to mimic connections between sets of data – simulating the neural network found in the human brain.[22] According to Bešlić et al, neural networking models today have become one of the most common bankruptcy prediction methodologies.[23] While insolvency (financial stress) prediction algorithms are not new, the widespread use of Neural Network and deep learning AI in bankruptcy predications is particularly notable.

[22] Owen Hall, Owen, Charles McPeak, 'Using Neural Net Technology to Analyze Corporate Restructuring Announcements' 2003 12 JIIM 1.
[23] Bešlić Obradović, D., Jakšić, D., Bešlić Rupić, I., & Andrić, M. (2018) 31(1) 'Insolvency Prediction Model of The Company: The Case of the Republic of Serbia' *Economic research-Ekonomska istraživanja*, 139.

The use cases of predictive AI goes beyond insolvencies to even managing a restructure. Ordinarily, when a company undergoes a restructure, it will record an 'estimated' expense on its balance sheet, and a reserve is then set up for that amount. Firms use a routine financial technique while selling an operating unit[24]. Whenever such a sale occurs during restructuring – it results in a single gain in the firms balance sheets that could cause a spike in earnings. To avoid this, the firm usually records a 'restructuring charge' in their sheets that is almost equal to the gain. This charge is ordinarily seen as an estimate of future expense that arises on account of the restructuring. In this manner there are constant estimating future valuations, future risks and future variables to be computed by a firm both before bankruptcy and during restructuring so as to ensure efficiency and quick resolution of assets. Predictive technologies built on Artificial Neural Networking models can be of tremendous assistance here. Lastly, predictive technologies can provide assistance even post the creation of resolution plan by creating artificial 'simulations' in digital environment and predict how likely in the resolution plan to succeed. As financial markets become more complex, insolvencies become large and complex and technologies become further advanced - Insolvency practitioners are bound to find themselves in an era of 'big data'.[25] Supplementing human intelligence with modern AI is perhaps the only way for firms to compete and survive in this age. Having said that, risk prediction models are not completely infallible – they have certain inherent problems that will be demonstrated in section IV. Therefore, the most mindful approach would be to use AI prediction software as complimentary to human intelligence.

[24] ibid.
[25] Christian Toms, Jane Colston, 'The Role of Artificial Intelligence (AI) and Technology in Global Bankruptcy and Restructuring Practices' (2019) Insol International.

B. Big Data Analytics

Insolvency and the creation of a resolution plan demands a huge amount of data and documentary information – both quantitative and qualitative. Further, this data can be structured (e.g. Accounting data) and unstructured data (voice mail and e-mails). The inputs to a resolution plan also include data from commercial databases, information from other resolution authorities, unstructured web sources, routine reports from financial firms, and occasional findings from on-site inspections. Traditionally, resolution authorities use in house based data warehouses. Most insolvency practitioners and resolution authorities work with overwhelming amount of data sets – usually in the form of spreadsheet based applications such as Microsoft Excel. The methods of data processing and data storing hence needs to be revolutionised in insolvency and restructuring so as to ensure timely resolution. The following are some of the current technologies that are revolutionising data processing and storage:

Technology aided review ("TAR"): TAR technology is used to conduct an automated review of any documents, books or records of the company being assessed using big data analytics and machine learning. TAR technology is able to cluster documents by concepts so humans can quickly begin to review concepts and subject areas. A report by INSOL International[26] provides five clear use cases for TAR technologies in insolvencies – when investigating complex and large insolvencies; when the resources and time is limited to establish working of a business; in turnaround scenarios to develop the most effective strategy; when tracing assets; when considering potential litigations to identify key trends, anomalies and time periods of specific interest. Additionally, TAR technologies when integrated with machine learning can be made to learn what human reviewers consider relevant and

[26] n 14.

what they don't by 'training'. Bayesian updating[27] and predictive coding can then be utilised to apply this learning to the rest of the data set and cut back a lot of the delays in data analysis. However, the same Insol report in their survey found that a small percentage (35%) of IP's had confirmed using TAR technologies and further a meagre 28% had confirmed using the more sophisticated machine learning capabilities of TAR.[28] The reasons for such law adoption is lack of education and awareness and perceived cost effectiveness of TAR softwares. However, partly driven by competition from other firms and partly by time and cost saving TAR assisted reviews can help make as compared to human only review – the ubiquity of TAR assisted document reviews in inevitable.

Cloud Storage: Storage of data and accessibility of data to multiple participants whilst insuring data privacy and integrity can further be bolstered by using 'cloud services'. In the survey conducted by Insol, almost half of the Insolvency Practitioners assented to having used often or have encountered cloud computing technologies within their insolvency practices indicating the already wide-spread use of cloud storage technologies in insolvency practise. However, the use of cloud computing technologies comes with certain concerns as well namely, data integrity and security; risk of deletions and corruptions; the difficulties inherent in seeking to secure and access a virtual server, who might lawfully have access and passwords to the cloud service, whether the insolvent entity or in reality another party; and finally jurisdictional issues that stem of where the servers hosting the cloud is physically located. Many of these issued can be solved by integrating private

[27] Bayesian updating is a method of revising probabilities based on new evidence. Starting with an initial belief (prior), you adjust this belief by considering how likely the new evidence is if the belief were true (likelihood). This process yields a revised probability (posterior), which incorporates both the initial belief and the impact of the new evidence.
[28] n 14., 9.

ledger technologies within cloud servers however that is an area of speculation as of yet. However, various convincing suggestions have been made to include blockchain technology in the Indian Information Utility database such as infusing trust in the NeSL system, making the data more secure and possibility of introducing smart contracts.[29] Whether that instrumentalises in actual reality is something to look out for.

There could be many other use cases for data analytics and big data computation in insolvency practices. Furthermore, big data can be integrated into any of other technological methodology such as TAR etc. to produce innovative solutions. What justifies having 'data analytics and big data' as a separate disruptive technology amongst the five its focus on 'data' that gives such technologies a unique distinguishing feature. Data today has become arguably, a separate asset class. Corporates (or Data Fiduciaries as per the Indian Digital Personal Data Protection Act) collect and sell our data each millisecond. In fact, certain business models such as Social Media Direct Marketing and Biotechnology cannot function without data as an asset class. How insolvency is to deal with this new asset class is a moot question. Corporation Insolvency Resolution Process ('CIRP) is similarly deeply contingent on the availability and analysis of financial data. This focus on 'data' as a separate asses class will become clearer in section IV where I shall address its challenges.

C. Distributed Ledger Technologies (Blockchains)

Blockchain is defined as a technology that is secure, immutable, decentralized and distributed string of unique 'blocks' carrying data. These blocks are chronologically arranged and each is given its own time stamped

[29] Ankeeta Gupta, 'Information Utilities And Blockchain: An Unlikely But Holy Partnership' (2022) IBBI Research Initiative https://ibbi.gov.in/uploads/publication/6b683482bf24ca7023aa99c8ef198bd8.pdf accessed 6 March 2024.

code. The block are then verified using hashing with all the other blocks in a chain – this ensures data immutability and security. The fundamental use case blockchain serves is the 'digital trust' is offers by eliminating the need for a third party to facilitate information exchange. The ledger can thus be programmed to conclude transaction automatically once a certain condition is met. However, smart contracts and data storing using distributed ledger is still in its infancy as the Insol survey indicated where only a meagre 10% of the surveyed IP's stated to have come across smart contracts or data storage in distributed ledgers. Most IP's and insolvency lawyers and practitioners are unaware of the potential opportunities blockchain technology created for the insolvency profession. In this sub-section I discuss four use cases of block chains namely, Tokenization of assets as a solution to the problem of the distressed debt market; resolution voting on a blockchain; security/automatic validation and smart contracts; and finally upgradation of data storage via ledger integration in Information Utility (IU's).

D. Tokenization Of Assets To Make Distressed Debt Market More Liquid

One of the seminal reasons plaguing insolvency resolutions and liquidation proceedings is the absence of a market for distressed debt. Ultimately when assets are sold off in liquidation or on account of restructurings – the market ultimately finds a lack of investors to purchase such assets.[30] Hence, under IBC, asset sale goes through rounds of 'haircuts' that greatly reduces the value of the asset and militates against the claim of asset maximization. Assets sold off during insolvency or liquidation proceedings tend to have a high entry barrier gives their high costs. These assets can be made more attractive to a major chunk of investor is the entry

[30] Navrang Saini's, 'IBC: Developing a Market for Distressed Assets' (From Chairperson Desk) https://www.ibbi.gov.in/uploads/resources/b7d255fa23b6d70f3dda575e9ec0dfae.pdf.

barrier is reduced through fractional ownership – this is precisely the benefit asset tokenization on a blockchain would offer.[31] Asset tokenization refers to the process of recording the rights to a given asset into a digital token that can be held, sold, and traded on a blockchain. Tokenization of real estate interests is a win-win for both investors and fund businesses acting as the issuing entity because it frees investors from the illiquid, long-term confinement and high entry barrier while simultaneously reducing the transaction costs and providing an automated and facilitated tax and regulatory compliance process for companies issuing tokens.[32] To summarize – tokenization via fractional ownership creates liquidity in an otherwise illiquid market. The usage of blockchain could be particularly in auction sales under 11 U.S.C. §363 which demands the debtor or resolution professional to market its assets to potential buyers and further involves several intermediaries that are necessary for the verification and approval of the debtor's sale of his assets. Blockchain has an added advantage of taking away these intermediaries in the process of asset sale. Smart contract automation within blockchains can for instance lower the cost of a transaction by eliminating the fees paid to multiple intermediaries.[33] An added advantage that comes from the elimination of intermediaries is the two contracting parties can ascertain a trues 'Net Asset Value' for their investment. However, 'blockchain securities' themselves pose significant harms to insolvency regimes – not so much in its assistance during the asset sale but rather when the estate that goes bankruptcy itself consists of blockchain securities like

[31] George Sazandrishvili, Asset Tokenization on Blockchain Explainedin Plain English*, (Medium,* 19 May 2018) https://medium.com/coinmonks/asset-tokeniization-on-blockchain-explained-in-plain-english-f4e4b5e26a6d accessed 8 March 2024.
[32] Ryan M. Mardini, 'Point of Intersection Where Blockchain Meets Bankruptcy: Can the Ingenuity of Blockchain Restructure and Streamline the Bankruptcy Process' (2020) 3 Wayne St UJ Bus L 8.
[33] ibid (n 25).

crypto. Such assets may present two principled problems – one, they conceal the identity of the 'owner' and the 'buyer' thus making it hard to determine ownership especially with regards to ascertaining which assets to include within the bankruptcy estate and which assets to exclude. Further the 'immutable' nature of transaction conducted on a blockchain can be a serious challenge for the courts or resolution authorities in dealing with avoidance transactions.[34] These challenges from blockchain bases securities are later analysed in section IV.

E. Voting on a Blockchain

During the approval of a resolution plan, the creditors ordinarily are to vote on the reorganization plan (applicable to creditor in control insolvencies). Only when a plan is approved can the restructuring be undertaken. Due to automatic verification and the immutable nature of blockchain ledges, there has been considerable talk of how the electoral voting process can be conducted on blockchains.[35] The same reasoning can be attributed to the voting during the approval of resolution plans. Voting process during approval of resolutions plans are highly complex because they include differential rights based on the nature and volume of credit owed. This complexity becomes increasingly pronounced in large scale insolvencies involving a huge number of creditors. Distributed ledgers are flexible and governed by code-based rules – hence algorithms can be programmed into the ledges that only allows votes to be counted if the system allows it. Thus, proportional voting rights can be automated and coded into the blockchain, which could automate much of the voting process during resolution approval process without human

[34] Renato Mangano, 'Blockchain Securities, Insolvency Law and the Sandbox Approach' (2018) 19 Eur Bus Org L Rev 715.

[35] Mike Montgomery, One Place Where Blockchain Could Really Help: Voting' *(Forbes,* 21 February 2018), https://www.forbes.com/sites/mikemontgomerv/2018/02/21/one-place-where-blockchain-could-really-help.

errors. While some may argue that implementing such a blockchain architecture and then scale is not cost efficient especially for large insolvencies, however a bespoke cost effective blockchain system can be designed using existing cost-mitigating strategies. For example, one may use a 'private or permissioned blockchain' to reduce transaction fees, using a Proof of Stake (PoS) consensus mechanism instead of Proof of Work which would require less expense on compute power and using automated smart contracts to save external costs such as vote counts and result tallying. Most of these blockchain architecture are available today as 'open source' codes hence, I would argue that in the long term, such technologies are cost-saving.

F. Updation of Information Utility

The India on September 25. 2017 introduced a 'one of a kind' concept of 'Information Utility' to integrate with its ins.[36] The success of the corporate insolvency resolution process hinges on the availability of complete, up to date and correct information and data about the debtor, his assets, and the totality of credit inter alia. This data and information is usually not available to every creditor and stakeholder in equal measure – leading to asymmetry of information. The non-availability of information may significantly compromise on the value maximising goal of insolvency resolution process and information asymmetry may lead to uneven sharing and discrimination amongst various stakeholders. To combat precisely this problem, the Indian Insolvency and Bankruptcy Code introduced the concept of 'Information Utility' that functions a transparent and efficient repository relevant data for the purposes of insolvency resolution. In India there is, as of now, only one registered informational utility under the name of 'National E-Governance services limited or NeSL' While there is no evidence to show that NeSL itself

[36] T.K. Vishwanathan 'Banking Legislative Reforms Committee Report' (2015).

has faulty technology, the system in fact has a good 'muti-tier security feature' however it is also a truism that the Information Utility technology has not picked up significantly in India. The problem largely seem to be one of trust.[37] This is precisely where block chain can be utilised. The 'trust affirming' use case of blockchains through its decentralised, transparent and automatic verification process can be a revolution in the Information Utility system in India. Ankeeta Gupta, in her paper has made a valiant case for introducing block chain technology to solve the problem of 'trust' in the IU ecosystem in India.[38] The decentralized nature of blockchains, built on consensus algorithms that require data verification across all nodes rather than by a centralized authority, ensures data immutability, transparency, and auditability. This technology enables blockchain-based Information Utilities (IUs) to function securely and democratically, as Ankeeta argues, by preventing data control by any single authority. Blockchain's design allows IU users equal rights and access, fostering transparency. As Ankeeta explains, blockchain can enhance IUs in two ways: first, by timestamping, verifying, and authenticating data upon entry; second, by recording any changes in new blocks verified by all participants, blocking unauthorized alterations and preserving data integrity and trust. India's premier policy adjudicatory body Niti Ayog has re-affirmed the enormous use cases provided by blockchain technology.[39] There are various other advantaged Blockchain technologies offer to Information Utility such as, (a) A faster reference of determining whether a debt is in existence (b) facilitate the IPR/RP during Corporate Insolvency Resolution Process to collate all the transaction from the ledgers

[37] Ankeeta Gupta, 'Information Utility and Blockchain: An Unholy Partnership' (2022) IBBI Research Initiative.
[38] ibid at Pg. 48-55.
[39] Mr. Rajiv Kumar, Blockchain: The India Strategy Part 1, (2020) https://niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf.

and (c) The decentralized structure of the database eliminates the need for the IU entity to obtain acknowledgment of the debt from both the debtor and creditor. Instead, the transaction is simply recorded with a coded or hashed identifier, serving as unalterable proof of an acknowledged transaction between the two parties.[40] Blockchain has significant use cases in record keeping of credit information by disaggregating information asymmetry and procedural delays[41]. At the same time however, there are certain harms that blockchain based ledgers pose poses such as 'anonymity', 'lack of scalability' and a potential threat to sovereignty hence the implementation of blockchain technology must be calculated and modified through various algorithmic permutations such as utilizing private/permissioned blockchains to offer the maximum advantage.

G. LLM's and RegTech

The name 'RegTech' comes from the rather uncreative combination of the words 'regulation' and 'technology' and represents a great leap towards automation and streamlining of regulatory compliances.[42] These technologies automate legal compliance through the use large language models. The Financial Conduct Authority in the UK, defines RegTech as 'technologies that may facilitate the delivery of regulatory requirements.[43] These technologies use 'natural language processing' through 'rule-based algorithms'. Here a

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[40] Akaant KM, 'Blockchain Technology – can it be a panacea for the Ills ailing the IBC', in *IBC: Evolution Learnings, and Innovation* (IBBI 2023).

[41] Debanshu Mukherjee and Aditya Ayachit, 'IBC, Delays and Information Assymetries: Can Blockchains help?', in Quinquennial of Insolvency and Bankruptcy Code, 2016, IBBI (2021) "certain attributes inherent to blockchain (e.g., trust, security, transparency, immutability and cost reductions) make it a superior method of recordkeeping which could aid the insolvency framework under the Code".

[42] Saule T. Omarova, '*Dealing with Disruption: Emerging Approaches to Fintech Regulation'* (2020) 61 Wash. U. J.L. & Pol'y 25, 48.

[43] Financial Conduct Authority, "Feedback Statement, Call for Input on Supporting the Development and Adopters of Regtech" (2015) Available athttps://www.fca.org.uk/publication/feedback/fs-16-04.pdf, Accessed in 2015.

written 'rule' (think a law) is interpreted by a programmer and is coded into algorithm. Using decision tables and decision trees which provides the algorithm 'logic'.[44] Hence, these AI based technologies are trained on language and are 'generative' and not predictive – think in terms of ChatGPT but for law! They generate analysis through text based on interpreting other texts.[45]. Insolvency practices today have also been disrupted through these ingenious 'RegTech' technologies. As 'generative' AI becomes more advanced in inferential reason, logic and language analysis the use cases of RegTech will extend beyond mere compliances to actual legal advisory and legal assistance. An example of this is 'ROSS Intelligence' Ross can respond perspicaciously to legal questions after searching and scrapping data from legal databases integrating the information to its logic based rules system.[46] Similar to ROSS Intelligence, multiple RegTech technologies utilising natural language processing and employing large language can automate much of legal compliance and advisory work performed by lawyers in insolvency professionals and can provide quick legal advice to IRP's.

H. Process reforms through automation and digitization

Process reforms are essentially 'nuts and bolt reforms' that are done to simplify processes for a certain activity of a sector at a very micro-scale. They

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[44] Jain, Aditya Sushant. "An inter-disciplinary approach to automation technology in finance-what can history, law and data science teach us?" *ICTACT Journal on Soft Computing* 14, no. 01 (2023): 3154-3164. I have explained the simple working of RegTech softwares earlier, "software codes in RegTech are largely based on declarative statements which can then be combined into decision like tree branches, for example rules such as 'Do not offer mortgage requiring monthly payment of over $... to an applicant making less than $...".

[45] Ibid. See also John W. Bagby & Nizan G. Packin, 'RegTech and Predictive Lawmaking: Closing the RegLag between Prospective Regulated Activity and Regulation' (2021) 10 Mich Bus & Entrepreneurial L Rev 127.

[46] Amit Chowdhry, 'Law Firm Baker Hostetler Hires A 'Digital Attorney' Named ROSS' (*Forbes*, 17 May 2016) <https://www.forbes.com/sites/amitchowdhry/2016/05/17/law-firm-bakerhostetler-hires-a-digital-attorney-named ross/?sh=51c5e0d278c4>.

are small-scale tweaks but they can have a major impact overall[47]. It is my position, that the functioning of courts, resolutions authorities and administrative processes in insolvency and restructuring can be revolutionised using technology to users in 'process reforms'. This can be done through several ways - Firstly, the filling system for the initiation of CIRP should be made completely online through digitization. The system can make certain field to be filled necessarily; the registered office address and the corporate identification number can be populated automatically through the Ministry of Corporate Affair's portal and finally the IU certificate can be procured from the national NeSL portal.[48] India already has two portals – the MCA Portal and the NeSL IU portal from where data can be automatically procured online.[49] Once the filling process has been completed online, is rendered defect free and is numbered – an algorithm can be quickly coded which would automatically send intimation notices to the creditor(s), the debtor and other stakeholder digitally signed by the officer in charge of the registry. This automation of 'hearing notices' has two benefits, – *first*, that it will reduce the delays that arise after the application is listed but hearing notices are yet to be sent and *second,* that it will preclude the pleas by the corporate debtor that no intimation was received by her and thus do away with the practice of obtaining 'affidavits of service.' Once the order for the commencement of CIRP is approved by the AA, it is ready for pronouncement the next day. This procedure can be automated to automatically add the digital signatures of the members on the pronouncement day, with a digitally signed copy being directly sent to the counsel of record[50]. A digitally signed copy of the order

[47] Sanyal, Sanjeev and Arora, 'Akanksha Process reforms: Fixing the Nuts and Bolts' (2023) Delhi School of Public Policy & Governance <http://dsppg.du.ac.in/our-publications/>.
[48] V.K. Rajasekhar, 'Use of Technology in to improve NCLT functioning', in *IBC: Evolution Learnings, and Innovation* (IBBI 2023).
[49] ibid.
[50] ibid.

guarantees the integrity and immutability of the order, while simultaneously lowering litigation costs. The replacement of certified copies demanded by the AA can be replaced with digitally signed copies – these digital signatures can be recorded on a blockchain that will ensure utmost security and immutability.[51] As per the current principle in Insolvency framework in India, for Section 7 application - the adjudicating authority is to only apply its mind with regards to the existence of a debt. Once the threshold of the debt is met, the CIRP is bound to begin. This process can further be systematised by identifying certain standard elements in the orders passed by the AA's and further using machine learning software to automatically populate the order so that the AA will only have to apply its mind to the existence of debt.[52] There are various other process reforms that can be undertaken such as by using technology in case scheduling, making hybrid hearing the norm rather than exception, completely doing away with physical documents or physically signed documents and utilising digitally signed documents, and many more!

IV. CHALLENGES POSED BY EMERGING TECHNOLOGIES

Having recognised the multifarious advantages and efficiencies emerging technologies present towards revolutionising, streamlining and fastening up the insolvency and resolution process in countries – they also come with significant threats. The threats posed by such technologies have been acutely absent from the academic discourses surrounding the impact of emerging technologies in insolvency practices. This is precisely the gap this section aims to fulfil. Before venturing on to the exact perils of technology within insolvency practices it is important to set the scope. Each of these 'challenges' such as those emanating from crypto or cloud computing can

[51] ibid.
[52] ibid.

make for a whole individual paper – this paper would only offer a brief overview of such challenges and shall accustom the reader to the most significant harms that these technologies present, hence this section is does not purport to be exhaustive.

In this section, I have categorized the perils of technologies in insolvency and bankruptcy practices into three buckets namely:

- Perils of AI in predictive bankruptcy
- Perils of RegTech in insolvencies
- Perils of insolvencies of 'new technological asset classes'

I believe these three buckets cover most if not all of the current threats technologies pose towards insolvency and bankruptcy practices cross-jurisdictionally. It is my position that such 'technological threats' arise from the inherent and unique characteristics of the underlying technology and the used & the consequent human reactions to them and thus I have eschewed from utilising a 'technology neutral' position throughout this section.

A. Perils of AI in predictive bankruptcy:

1. AUTOMATION BIAS

Risk prediction technologies' are not infallible and often can produce errors; nevertheless, our financial and other institutions suffer from a deep and pervading automation bias.[53] This 'automation bias' amongst those working in finance was a key reason in the 2008 global financial crisis. Take for example VAR (value-at risk) risk predicting technology that were used almost ubiquitously during the 2000's. Even the Basel accords permitted VAR reports to be submitted a sufficient measure of risk.[54] The software used

[53] A. Bamberger, Kenneth, "Technologies of Compliance: Risk and Regulation in a Digital Age" (2010) TLR 88.

[54] See Minimum Capital requirements for market risk Standards (2016) Basel Committee on Banking Supervision accessible at: https://www.bis.org/bcbs/publ/d352.pdf "*Where a bank*

regression and correlation methods to analyse "market risks" and chart out its 'probabilistic interconnectedness' in a certain time usually by representing them as percentage points called 'confidence levels.' In summary, it uses ML to create simulations of various risk sources and uses regression to distribute risk amongst a large number of outcomes. Traditional financial models face a major flaw: they are "backward-looking," relying on past data to predict future events. This approach is problematic, especially as economic cycles shift; data from an up-credit cycle is unreliable for down-credit predictions. Financial markets often behave irrationally and are influenced by "black swan" events, such as extreme fiscal reactions to geopolitical crises, as seen in 2008. Value-at-Risk (VAR) models, based on data from earlier events, inaccurately showed rising mortgage prices during the 2008 crisis and failed to capture extreme market risks beyond their 95%-99% confidence limits. Nevertheless, financial firms, overly confident in VAR's complexity and efficiency, began to replace risk analysts and relied heavily on VAR for issuing Credit Default Swaps on mortgage-backed securities. This exemplifies "automation bias"—the tendency to overly trust AI-driven systems and disregard suspicions, even when there is evidence of malfunction. When high stakes are involved, automation bias can lead to wishful thinking, sham business practices, and a dangerous abdication of oversight and regulatory responsibility, creating a "crisis in due process."[55]

Complex Bankruptcy prediction models thus can lead to market wide 'automation bias' due to their ever increasing complexity. While predicting insolvencies or defaults, often prediction models can give wrong warnings due to error in data sets. As these fast becoming neural networking models using

has a VaR measure that incorporates specific risk and that meets all the qualitative and quantitative requirements for general risk models, it may base its [specific risk capital] charge on modelled estimates . . .".

[55] Danielle Keats Citron, "Technological Due Process", (2008) *85* Wash. U. L. Rev. 1249.

in default prediction false alerts in financial sectors or a false predictions of health in otherwise unhealthy companies will go un-questioned. Bankruptcy Risk predictions models not only suffer from expired data sets but also through problems of overfitting, underfitting, modelling on fallible human assumptions[56] and human bias integrated in the code[57]. Hence, while the efficiency of these models cannot be discounted – they must not lead 'automation bias's and must not be used as replacement to human risk analysis.

2. BLACK BOX MODELS

As I have discussed previously, Bankruptcy predictions have been historically moving to more 'complexity' where now the models are constantly using advanced AGI such as Neural Networks or Deep Learning models – which ultimately are 'black boxes' – i.e. those whose reasoning cannot be understood due to their sheer complexity. Frank Pasquale, in his book 'the Black Box Society: The secret algorithms that control money and information' has elucidate to a great many length about the harms posed by such black box models.[58] Black Box models simply refers to those models,

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[56] See for example John H. Walsh's statement, ohn H. Walsh, Assoc. Dir.–Chief Counsel, Office of Compliance Inspections & Examinations of U.S. Sec. & Exch. Comm'n, Remarks Before the NRS 21st Annual Spring Compliance Conference (April 18, 2006) (transcript available athttp://www.sec.gov/news/speech/2006/spch041806jhw.htm). "*If you set their parameters too high, they could miss important red flags. For example, if you have an electronic report that monitors for investment time horizons, but you assume that only investors under age 50 have investment time horizons, you could miss a lot of red flags relating to the elderly. Also, an electronic report cannot find red flags in data it does not have. For example, if you rely on your clearing broker for mutual fund exception reports, but do most of your business with the fund companies by way of "check- and-app," those clearing broker reports will not do you much good"*.

[57] Frank Pasquale, *The black box society: The secret algorithms that control money and information* (Harvard University Press 2015) "*Software engineers construct the datasets mined by scoring systems; they define the parameters of data-mining analyses; they create the clusters, links, and decision trees applied; they generate the predictive models applied. Human biases and values are embedded into each and every step of development. Computerization may simply drive discrimination upstream"*.

[58] n 54.

which have attained such high level of complexity that they are beyond human understanding. Human may observe their outcomes but fail to infer causality. These algorithms hide biases and discriminatory modelling until perpetuity, especially with regards to personal bankruptcies. For instance, a default prediction algorithm may give a low score to black person than a white person due to the black community having a higher rate of default historically in the given data set. These could happen because the data set within the model was un-representative. These default risk predictions can affect interest rate on loans for individuals and thus further inequality.[59] These algorithms when employed on a large scale lead to crisis of transparency, and maximises 'automation bias' in markets hence these algorithms must be employed in a controlled and careful fashion.

B. Perils of RegTech in insolvencies

Large Language Models (LLMs), like ROSS Intelligence, introduce significant challenges in legal contexts, particularly in insolvency practice. Similar to predictive AI, LLM-based RegTech tools encounter two primary issues: the "problem of translation" and the "Tower of Babel" dilemma. The translation issue arises because laws must be coded into the AI by engineers who may lack the nuanced interpretive skills that legal analysis demands. This mismatch was evident with Digital Rights Management (DRM) software, where engineers failed to encode the "fair use" doctrine properly, leading to restrictions that inadvertently contradicted copyright law. In insolvency law, LLMs might similarly struggle with subjective determinations, like assessing whether a "true sale" in a securitized transaction excludes it from a debtor's estate—a question that requires interpretive expertise beyond rigid coding.

[59] n 9.

The Tower of Babel issue refers to the overwhelming variety of financial terminologies, akin to the biblical story where linguistic diversity impeded communication. For LLMs to effectively address cross-border insolvency, there must be a standardized financial lexicon, as they are currently limited by regional language variations in financial law. Without such standardization, LLMs may struggle to deliver the global applicability necessary for handling cross-border insolvency cases, where diverse financial systems and terminologies intersect.

C. Perils in the insolvency of new 'technological asset classes'

As technology has progressed, it has led to the development and wide spread adoption of various 'new' asset classes such as crypto currencies and data. These new asset classes fall well out of the regulatory ambit of insolvency and bankruptcy frameworks across the worlds. Here, I shall briefly discuss certain problems regulators may face when they try to fit in these new asset classes within their traditional regulatory frameworks.

1. CRYPTO

The literature surrounding the problems faced by insolvency and resolution authorities and courts in dealing with crypto assets is rich[60]. Bitcoin (crypto) is a decentralized digital currency that allows peer-to-peer transactions over the internet on a blockchain without the need for a central authority like a bank or government. Scholars have realised that the peculiar nature of blockchains which renders these ostensible currency decentralised, pseudonymous and causes mercurial price fluctuations. These characteristics

[60] See for example, Megan McDermott, 'The Crypto Quandary: Is Bankruptcy Ready?' (2021) 115 Nw U L Rev 1921; Polina Lyadnova; Polina Lyadnova; Ekaterina Dorokhova; Hannah Whitney, "Cryptocurrencies in Insolvency: Evasive Reality," (2019) Pratt's Journal of Bankruptcy Law; Matthias Haentjens et al., The Failed Hopes Of Disintermediation:Crypto-Custodian Insolvency, Legal Risksand How To Avoid Them, (2020) Singapore Journal of Legal Studies; Lee Pascoe, "Digital Currency Exchanges, ICOs and Insolvency: The Story So Far," (2019) Insolvency and Restructuring International 13.

of crypto make it particularly hard to deal with crypto currencies especially in the context of insolvencies and liquidations. Crypto-currencies engender a heightened risk that debtors will use crypto to shield assets from creditors, they may pose grave valuation risks for liquidators especially due its intense price fluctuations which militate against the value maximisation purpose of Insolvencies and liquidations. The problem however starts on a definitional front – is crypto an asset, a currency or property.[61] The case *Re Hashfast Technologies* highlighted the ambiguity around classifying cryptocurrency in insolvencies. In this U.S. liquidation, the trustee argued that Bitcoin should be treated as a commodity, and thus liquidated, while the debtor argued it behaved as a currency and should be excluded from the estate. The court's lack of a definitive ruling underscored the challenges insolvency practitioners face in categorizing crypto assets. This ambiguity affects whether crypto is

[61] The definitional issues was seen poignantly in Re Hashfast Technologies, a US Liquidation court case concerning a tech copay that developed a technology that allowed bitcoin miners to outpace their competitors. The debtors possessed 3000 bitcoins which were sought to also be liquidated. The insolvency trustee argued that bitcoin should be treated as a commodity like gold etc that fluctuates in price placing reliance on an order from the Commodity Futures Trading Commission requiring cryptos to be regulated under its purview. Hence, the trustee argued that it should be taking within the insolvency estate and liquidated. On the other hand, the debtor argued that bitcoin should be treated as a currency since it 'behaves' as such, and thus should be exclude d from the insolvency estate. Even through the court did not conclusive answer this question however insolvency practitioners were made acutely aware of the ambiguousness of crypto currencies with respect to their insolvencies. Right at the outset – determining the character of crypto, whether they are to be treated assets, currencies, commodities, or property will determine whether they are included or excluded for the insolvency estate. If it is the former, the question remains as to how to liquidate them since a conversion of crypto in fiat currency would lead a sudden fall in its prices especially if the wallet size is particularly large and if it is the former, it can open an easy route to avoidance transaction by the debtor given that crypto is stored anonymously thereby shielding assets from creditors In fact, as has been argued by a scholar that certain decisions such as In re Peeples and In re Schultz which showcase a debtor friendly approach of bankruptcy courts encourage precisely the latter. Further, as was highlighted by the insolvency of crypto exchange Quadriga and Mt. Gox, crypto currencies give a false façade of liquidity. During the liquidation proceedings of Mt Gox, the price of bitcoin rose multifield and unsurprisingly the creditors asked the trustee to pay them in crypto, however the law did not permit payment in crypto – and hence, due to the lengthy process of liquidation, and converting bitcoin into fiat, the price of crypto fell leading to huge value loss to creditors.

included in an insolvency estate and raises concerns over liquidation impact, potential for avoidance transactions, and liquidity risks, as seen in high-profile cases like Mt. Gox and Quadriga. Hence, some scholars argue that requiring creditors to accept payment in bitcoin seems more fair then payments in fiat currency.[62] Yet another problem with crypto currencies is its ownership[63] especially with respect to crypto exchanges and wallets. Clearly, the anonymous, decentralised, and volatile nature of crypto currencies pose many problems for insolvency experts. Today, there are thousands of bitcoin exchanges, wallets, currencies etc. and due to its intense volatility some are bound to be bankrupt. For example, a famous crypto exchanged called Wazir X in India recently filed for insolvency in the Singaporean court after a 320 Million hack Problems arose in maying back the creditors of Wazir X in India since payment in fiat currency would have eroded the value of their coin altogether. A closed approach of bankruptcy laws towards crypto thus would not suffice. It has to clearly lay out how decentralised assets and currencies functioning over a blockchain are to be treated.

2. DATA AS AN ASSET

Economies today are data driven. Data in today, in effect, modern gold. Capital structures of companies in the 21st century will be starkly different from those of the past century. Once driven by hard assets, such as real estate, natural resources and machinery, modern businesses become highly dependent and valued on the basis of intangible assets – claims, licenses, know-how and goodwill. Increased value of data (e.g. customers' databases) in debtors' insolvency estates together with the expansive process of digitisation and data collection (big data) bring data protection issues to the

[62] ibid.
[63] Matthias Haentjens et al 'The Failed Hopes of Disintermediation: Crypto-Custodian Insolvency, Legal Risksand How To Avoid Them' SJLS, (2020).

forefront of legal and insolvency practice."[64] There are entire industries that revolve around storage and use of data – take for example biotechnology firms. However, a moot question that arises is that in the event such a firm goes bankrupt – what is to happen to its data? According to data privacy laws such as General Data Protection Regulation, EU ('**GDPR'**) and Digital Data Protection Act ('**DPDP'**), the data subjects have a right to withdraw or delete their data however, in the event the data controller (firm) undergoes insolvency – a moratorium is attached to the disbursement of their assets for the company to remain a going concern. What would happen to their data as an asset? Further, an ethical question yet again arises as to whether consumer data can be sold off during a CIRP, especially if it consists of sensitive personal data? Some scholars argue in favour of the data subject and posit that the relationship between host and the user with respect to data collection is that of bailee/bailor. Hence, the host possesses the data solely for the purposes of storage and the data subject maintains its ownership stake.[65] Since the data controller has no ownership stake, the date of the users would be excluded from the bankruptcy estate. However, Rebecca Perry disagrees. She argues that the concept of Bailment only applies to tangibles and hence would not apply to data.[66] The answer, I believe, ultimately lies on harmonization of data privacy laws and insolvency, restructuring and bankruptcy codes.[67]

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[64] Wessels, B., & Kokorin, I. Cross-Border Cooperation and Communication: How to Comply with Data Protection Rules in Matters of Insolvency and Restructuring (2019) 16(2) International Corporate Rescue 98.

[65] Matt Hafter, 'Data in the cloud: What if the cloud provider goes bankrupt' (*Thompson Coburn LLP* 7 March 2018) https://www.thompsoncoburn.com/insights/publications/item/2018-03-07/data-in-the-cloud-what-if-the-cloud-provider-goes-bankrupt.

[66] Re Hashfast Technologies (n 61).

[67] See for instance, Wessels, B., & Kokorin, I. (2019). Cross-Border Cooperation and Communication: How to Comply with Data Protection Rules in Matters of Insolvency and Restructuring. *International Corporate Rescue*, *16*(2), 98-103; Ronny Hauck, "Personal Data in Insolvency Proceedings: The Interface between the New General Data Protection Regulation and (German) Insolvency Law," (2019) 16 European Company and Financial Law

V. CONCLUSION

This paper underscores the transformative potential of emerging technologies, such as AI, ML, Big Data, and Blockchain, in reshaping insolvency, bankruptcy, and restructuring processes on a global scale. By offering a detailed taxonomy of these technologies, the research provides a framework for understanding how they can improve efficiency and decision-making for insolvency practitioners, resolution professionals, and adjudicating authorities. However, the integration of these tools also brings substantial challenges, including automation bias, complexities in codifying legal rules, and the novel issues posed by cryptocurrencies as assets. Ultimately, the findings of this paper highlight both the opportunities and the responsibilities of regulators and practitioners, providing a roadmap for the responsible integration of technology in insolvency practices. Through this roadmap, stakeholders are better equipped to harness innovation while safeguarding the integrity and stability of insolvency regimes in the 21st century.

Review (ECFR) 16: 724-745; Michael R. Fabrizio, "Data Privacy in Cross-Border Insolvency: A Fundamental Right or a Threat to Open Access," (2019) 2 NY International Law Review 32, 65.