

Developing an AI Model for the Detection of Financially Distressed Companies by Belgian Commercial Courts

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Abstract

Financial distress among companies poses a significant challenge to economic stability. Timely and effective intervention is needed. In Belgium, the Chambers for Companies in Difficulty (CCDs) within commercial courts play a crucial role in detecting and addressing financial distress through both preventive and regulatory measures. However, the current manual selection process for identifying companies at risk, based on so-called ‘red flags’, is resource-intensive and inconsistent across CCDs.

This paper explores the potential of artificial intelligence (AI) to improve the efficiency and objectivity of the CCD’s selection process. Using machine learning techniques, we are currently developing an AI model to assist the CCD in prioritising companies for review by ranking them according to urgency and providing an indication of the

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likely CCD decision. The model aims to streamline the selection process, reduce judicial workload, and enable CCDs to focus on companies requiring urgent attention.

As a contribution to the growing field of AI-driven legal decision support systems, our research offers insights for policymakers and courts seeking to integrate AI into insolvency proceedings. The proposed AI model will be a supportive tool to enhance efficiency and consistency. However, final decisions will always be made by CCD judges, thus preserving judicial discretion and ensuring procedural fairness.

Keywords: Artificial Intelligence, Insolvency, Commercial Courts, Legal decision support systems

1. Introduction

The integration of artificial intelligence (AI) into judicial systems is becoming increasingly important as courts seek to manage growing caseloads, enhance efficiency, and improve decision-making processes.⁸ Insolvency law, in particular, presents a compelling case for AI adoption.⁹ Traditional insolvency proceedings are often time-consuming and resource-intensive, requiring courts and insolvency practitioners to manually process large volumes of financial data and legal documents. AI offers promising opportunities to streamline these processes by automating routine tasks (such as filing procedures) and to analyse vast amounts of data (e.g. to identify financially distressed companies¹⁰).

A notable example of AI implementation in insolvency law can be found in the Colombian judiciary, where an AI-based system automates bankruptcy filing, verifies document completeness and even drafts preliminary decisions for judicial review.¹¹ This system significantly expedites case processing, illustrating AI's potential to transform insolvency proceedings.

8 Cf. Floris Bex and Henri Prakken, 'Can predictive justice improve the predictability and consistency of judicial decision-making?' in Erich Schweighofer (ed.), *Legal Knowledge and Information Systems. Jurix 2021: The thirty-fourth Annual Conference* (IOS Press 2022).

9 Cf. Christoph Henkel, 'The impact of artificial intelligence on insolvency law and practice' in Paul Omar and Jennifer Gant (eds.), *Research Handbook on Corporate Restructuring* (Edward Elgar 2021). See also: Aurelio Gurrea-Martínez, 'The Digitalization of Insolvency Proceedings' (2025) 34,2 *Int. Insolv. Rev.* 475.

10 Cf. Harry Lawless, 'Insolvency Prediction Techniques for Debtors', (2024) 8 *Journal of Business Law* 648.

11 See Nicolás Polanía Tello, 'Columbia is using AI to improve insolvency proceedings' (21 April 2022), <https://www.lexology.com/library/detail.aspx?g=833800ef-65d9-42e0-89ab-d4436d0468d8>. See also the description by Akshaya Kamalnath, 'The future of corporate insolvency law: A review of technology and AI-powered changes', (2024) 33 *Int. Insolv. Rev.* 40.

This paper examines the development of an AI model to support the Chambers for Companies in Difficulty (CCDs) within Belgian commercial courts. These chambers play a crucial role in the prevention of insolvency by proactively identifying companies in financial distress, encouraging them to take measures to recover when possible. When recovery is no longer feasible, the CCDs ensure the orderly removal of non-viable companies from the market, thereby contributing to the overall stability of the economic system. However, the current manual selection process is time-intensive, often inconsistent, and constrained by limited human capacity. Given the availability of centralised data through KNICLI (i.e. a digital database of red flags of financial distress), AI offers the potential to increase the CCD's efficiency and objectivity while allowing judges to focus on more substantive legal and economic assessments.

This paper is structured as follows: Section 2 provides an overview of the CCD's structure and role within the Belgian legal system, highlighting its preventive and regulatory tasks. Section 3 discusses the potential of AI to improve the functioning of the CCD, particularly in the selection of companies for investigation. Section 4 outlines our pilot project conducted at the Commercial Court of Antwerp, focusing on data collection and preliminary results. Section 5 presents conclusions and directions for future research.

With this paper, we aim to demonstrate how AI can serve as a transformative tool in insolvency proceedings, offering solutions to challenges in the timely identification of financially distressed companies, thereby increasing the likelihood of successful business recovery and reducing the risk of unnecessary bankruptcies.

2. Chambers for Companies in Difficulty (CCDs) within Belgian Commercial Courts

In Belgium, each commercial court has one or more Chambers for Companies in Difficulty (CCDs).¹² These chambers are composed of one professional judge and two lay judges with expertise in business matters.

The primary function of the CCD is the proactive detection and investigation of companies experiencing financial difficulties.¹³ On the one hand, the CCD has a **preventive role**: it aims to raise awareness among distressed companies regarding their financial challenges and encourage them to take measures to resolve these

¹² Article 84 Belgian Judicial Code.

¹³ Article XX.25 Belgian Code of Economic Law.

issues.¹⁴ The ultimate goal is to prevent these companies from going bankrupt. On the other hand, the CCD has a **regulatory role**: when a distressed company shows no intention or capacity to recover, the CCD has the task of removing it from the market. This typically applies to virtually insolvent companies or to shell entities. The CCD leads these companies towards bankruptcy or dissolution proceedings, thereby contributing to the orderly functioning of the economic system.¹⁵

The CCD is sometimes described in the literature as an ‘economic hospital’ for financially ‘ill’ companies. Where recovery is still feasible, the CCD provides guidance and support for rehabilitation. Conversely, for companies beyond recovery, the CCD helps to ensure their orderly market exit, whether through bankruptcy or dissolution¹⁶ (see below under Sections 2.2 and 2.3).

In Belgium, both bankruptcy and dissolution lead to the liquidation of a company¹⁷, but they differ with regard to legal grounds and procedural requirements. Bankruptcy proceedings only apply when a company is insolvent, meaning that it has permanently ceased to pay its debts and can no longer obtain credit.¹⁸ Dissolution, by contrast, is a broader legal mechanism for terminating a company, regardless of its solvency status. CCDs may refer companies for dissolution proceedings in specific circumstances, particularly to address dormant companies. For example, dissolution may be proposed when a company has failed to comply with its legal obligation to submit its annual accounts to the Central Bank of Belgium¹⁹ or when it has failed to appear before the CCD after being summoned twice.²⁰

14 Pierre-Yves de Harven, Jean-Benoît Hubin, Martin Marinx and Damien Philippot, ‘La chambre des entreprises en difficulté : un “couteau suisse” au service des entreprises en difficulté et de leurs créanciers’ in Frédéric Georges and Florence George (eds), *Varia en droit de l’insolvabilité* (Anthemis 2022), para 1; Hans Van den Nieuwenhof, ‘De opsporing van ondernemingen in moeilijkheden’ in Herman Braeckmans, Stan Brijs, Henri Colman and Miet Debucquoy (eds.), *Faillissement en reorganisatie* (Kluwer, 2023), para 20.

15 Idem.

16 Frederik De Leo, ‘Het Belgische insolventierecht na de omzetting van de Europese Herstructureringsrichtlijn: een eerste overzicht’ (2023) *Tijdschrift voor Rechtspersoon en Vennootschap* 391, 394; Eric Van den Broele, ‘De ondernemingsrechtbank als economisch ziekenhuis’ (2020) 69 *In Foro* 3; Hans Van den Nieuwenhof, ‘Knipperlicht in de duisternis voor de kamer voor ondernemingen in moeilijkheden’ (2022) 74 *In Foro* 5.

17 Gauthier Vandenbossche, ‘Judicial dissolution of “empty estates” as Belgian alternative for bankruptcy proceedings’ in Emilie Ghio and Eugenio Vaccari, *The Perpetual Renewal of European Insolvency Law* (INSOL 2024) 114.

18 Article XX.99 Belgian Code of Economic Law.

19 Article 2:74, §1 Belgian Code of Companies and Associations.

20 Article 2:74, §2 Belgian Code of Companies and Associations.

From a comparative law perspective, the Belgian CCD system is relatively unique. However, it shares some similarities with the *procédure d'alerte* in France. Under the French system, the president of the court has a *droit de convocation*, i.e. the authority to summon companies in financial difficulty and encourage them to take appropriate measures to recover.²¹ Both systems share a common preventive aim: proactively addressing financial distress to avoid insolvency. Nevertheless, the Belgian CCD's dual mandate, which combines this preventive role with a regulatory function aimed at removing irrecoverable companies from the market, distinguishes it as a more structured approach to addressing and resolving financial distress.

Each CCD operates through a structured process to identify and investigate financially distressed companies within its jurisdiction. This process involves three key steps: identifying companies in difficulty based on red flags for financial distress collected by the court registry (see Section 2.1), selecting specific companies for further investigation, given practical and resource constraints (see Section 2.2), and making final decisions on the selected companies following their investigation (see Section 2.3).

2.1 Detection of companies in difficulty

2.1.1 Red flags indicating financial distress

To detect financially distressed companies, the registry of the commercial court gathers data known as 'red flags'. These are indicators suggesting potential financial distress and a need for immediate intervention.²²

While the law enumerates several statutory red flags, this list is not exhaustive. The registry may also collect other relevant information on financially distressed companies. The presence of multiple red flags for the same company significantly increases the likelihood of financial distress.

Statutory red flags indicating financial distress include:²³

- Enforcement measures taken against the company (e.g. seizures)
- Default judgments
- Judgments dissolving commercial leases due to non-payment
- Debts to public creditors, such as outstanding tax debts or unpaid social security contributions
- Changes in the company's number of employees

21 Article L611-2 French Code of Commerce. See Caroline Houin-Bressand, Marie-Hélène Monsérié-Bon and Corinne Saint-Alary-Houin, *Droit des entreprises en difficulté* (13th ed., LGDJ 2022) paras 234 ff.

22 Article XX.21, §1 Belgian Code of Economic Law.

23 Article XX.22/1 and XX.23 Belgian Code of Economic Law.

- Relocations of the company's registered office
- A low score on the Financial Health Indicator (FHI) calculated by the Central Bank of Belgium based on solvency, liquidity and profitability metrics from the annual accounts submitted by the company
- Reports (though rare) from economic professionals, such as accountants or auditors, indicating that the continuity of the company is under threat.

Beyond these statutory red flags, the registry also receives reports from third parties, such as notifications from police officers regarding fictitious company seats. Furthermore, the annual accounts submitted to the Central Bank of Belgium also provide valuable financial insights. Delays or failures in submitting these accounts are often themselves a sign of financial difficulties.²⁴

2.1.2 KNICLI: a central database for red flags

Since 2021, several red flags have been centralised in a digital database known as KNICLI (*KNIppерlichten – CLlgnotants*, meaning 'red flags' in Dutch and French).²⁵ This system includes data on:

- Outstanding social security contributions
- Outstanding VAT debts (including details of payment plans)
- Outstanding income taxes (including details of payment plans)
- Amounts subject to enforcement measures (e.g. seizures)
- Number of default judgments
- Number of judgments dissolving commercial leases due to non-payment
- Delays in filing annual accounts with the Central Bank of Belgium
- Number of employees
- Financial Health Indicator (FHI).

The KNICLI database was developed to assist CCDs in identifying financially distressed companies. By integrating a large number of red flags into a centralised digital database, KNICLI enables a more efficient identification and selection of companies for investigation. For instance, it includes pre-defined lists, such as 'zombie companies' (companies that have failed to submit their annual accounts to the Central Bank of

24 Hans Van den Nieuwenhof, 'De opsporing van ondernemingen in moeilijkheden' in Herman Braeckmans, Stan Brijs, Henri Colman and Miet Debuquoy (eds.), *Faillissement en reorganisatie* (Kluwer, 2023), para 45.

25 Royal Decree of 13 June 2021 concerning the Central Register of Economic Red Flags for the Detection of Financially Distressed Companies, *Belgian Official Gazette* 25 June 2021.

Belgium for multiple years)²⁶ and a 'recidivism' list (companies previously investigated by the CCD). The KNICLI database also allows for customised queries, enabling the identification of companies with specific red flags, such as outstanding social security contributions or outstanding VAT debts exceeding a specified threshold. Additionally, the database can generate individualised 'KNICLI reports' providing a comprehensive overview of all red flags for a particular company.²⁷

Despite its benefits, KNICLI also has several limitations. First, it does not include all possible red flags for financial distress (but only a selection of red flags). Second, available data on judgments lack detail, providing only the number of judgments without their substantive content. Third, some data, particularly on outstanding debts, are not always up to date. These limitations affect the extent of KNICLI's usage across CCDs, although some, such as the CCD of the Commercial Court of Antwerp (see Section 4), make extensive use of it.

2.2 Selection of companies in difficulty

Given the large number of companies flagged in the KNICLI database, it is neither feasible nor practical for the CCD to start an investigation for every company. A selection process is therefore necessary, but this process lacks a standardised procedure and fixed criteria, leading each CCD to adopt its own approach.²⁸

Selection practices vary significantly across CCDs. In some CCDs, the registry oversees the selection, while in others, the president of the CCD directs the selection process. Some CCDs actively use the KNICLI database for the selection of companies, whereas others do not. However, even when KNICLI is used, the criteria for selection often differ not only between CCDs but also within the same CCD over time. For

26 In the economic literature, the term 'zombie companies' has another meaning, referring to companies that remain operational despite being unprofitable and unable to generate sufficient cashflow to cover their debts, often surviving due to prolonged access to cheap credit or government support, which can have a major negative economic impact. See Olivier De Jonghe, Klaas Mulier and Ilia Samarin, 'Bank Specialization and Zombie Lending', (2025) 71,2 *Management Science* 1260.

27 Hans Van den Nieuwenhof, 'De opsporing van ondernemingen in moeilijkheden' in Herman Braeckmans, Stan Brijs, Henri Colman and Miet Debucquoy (eds.), *Faillissement en reorganisatie* (Kluwer, 2023), para 53.

28 Pierre-Yves de Harven, Jean-Benoît Hubin, Martin Marinx and Damien Philippot, 'La chambre des entreprises en difficulté : un "couteau suisse" au service des entreprises en difficulté et de leurs créanciers' in Frédéric Georges and Florence George (eds), *Varia en droit de l'insolvabilité* (Anthemis 2022), para 13; Hans Van den Nieuwenhof, 'De opsporing van ondernemingen in moeilijkheden' in Herman Braeckmans, Stan Brijs, Henri Colman and Miet Debucquoy (eds.), *Faillissement en reorganisatie* (Kluwer, 2023), para 58; Ivan Verougstraete, *Manuel de l'insolvabilité de l'entreprise* (Kluwer 2019) para 264.

instance, a CCD might prioritise companies with significant outstanding social security debts one month, while the next month it may focus on companies with significant outstanding VAT debts. This variability can lead to inconsistencies and increased risk that financially distressed companies are either overlooked or addressed too late.

The selection process is predominantly manual, requiring substantial time and effort from judges and registry staff. This challenge is further exacerbated by the large volume of data contained in the KNICLI database, making it difficult for individuals to process all the available information effectively.

Once a company is selected, the registry prepares a concise file on the company. This file may include a KNICLI report, data from the Crossroads Bank for Enterprises, third-party documents, and financial information from sources such as Graydon-Creditsafe (a Belgian private credit bureau). The file is then submitted to the CCD (or, in some cases, directly to its president), which evaluates the company's situation and determines the appropriate course of action.

The CCD may take the following decisions:²⁹

1. **Closure of the Case:** If the company's continuity does not appear to be at risk, the CCD may close the case.
2. **Deferral for Re-evaluation:** When no immediate threat is identified but further monitoring is deemed necessary, the case may be scheduled for a future review.
3. **Request for Additional Information:** The CCD may request additional information from the company, such as detailed financial records, before deciding whether to initiate an investigation.
4. **Initiation of an Investigation:** If the company's continuity is threatened, the CCD may start an investigation or appoint a reporting judge to conduct it. Both the CCD and the reporting judge may summon the company to provide additional information on its financial and operational status.³⁰
5. **Immediate Referral for Bankruptcy or Dissolution:** If the company's condition is critical and recovery is deemed impossible, the CCD may immediately lead the company towards bankruptcy or dissolution proceedings.

29 Hans Van den Nieuwenhof, 'De opsporing van ondernemingen in moeilijkheden' in Herman Braeckmans, Stan Brijs, Henri Colman and Miet Debucquoy (eds.), *Faillissement en reorganisatie* (Kluwer, 2023), para 59; Ivan Verougstraete, *Manuel de l'insolvabilité de l'entreprise* (Kluwer 2019) para 264.

30 Article XX.25, §2 Belgian Code of Economic Law.

2.3 Possible final decisions of the CCD

Once the investigation into a selected company is completed, the CCD may issue several types of final decisions, depending on the company's situation:³¹

1. **Closure of the Case:** If the company is no longer in financial distress, or if it has been declared bankrupt during the investigation, the CCD may close or archive the case.
2. **Referral for Bankruptcy:** When the investigation reveals that the company is insolvent, the CCD may refer the case to the public prosecutor to initiate bankruptcy proceedings³² before the insolvency chamber of the commercial court.
3. **Referral for Dissolution:** If the investigation reveals grounds for dissolution of the company, such as failure to submit annual accounts to the Central Bank of Belgium, the CCD may refer the case to the dissolution chamber of the commercial court.³³
4. **Appointment of a Provisional Administrator:** In cases where insolvency is identified and there is a significant risk of asset dissipation, the CCD may recommend the appointment of a provisional administrator.³⁴ This rarely used measure results in the company losing full or partial control over its assets or operations.³⁵
5. **Appointment of a Restructuring Expert:** At the request of the distressed company, the CCD may appoint a restructuring expert to facilitate recovery efforts.³⁶

These decisions reflect the CCD's dual mandate: to prevent bankruptcies when possible and to ensure the orderly removal of unviable companies from the market. By balancing these roles, the CCD contributes to economic stability while fostering opportunities for recovery where feasible. Indeed, it is of great societal importance that scarce resources like capital, labour, or credit are being used efficiently by companies. The CCD therefore creates economic value by encouraging failing companies to take action and use their resources more efficiently or by foreclosing inefficient companies and allow their resources to be reallocated elsewhere in the economy.

31 Hans Van den Nieuwenhof, 'De opsporing van ondernemingen in moeilijkheden' in Herman Braeckmans, Stan Brijns, Henri Colman and Miet Debuquoy (eds.), *Faillissement en reorganisatie* (Kluwer, 2023), paras 82-100.

32 Article XX.29, §1 Belgian Code of Economic Law.

33 Article XX.29, §2 Belgian Code of Economic Law.

34 Article XX.29, §2 Belgian Code of Economic Law.

35 Article XX.32, §1 Belgian Code of Economic Law.

36 Article XX.29/2, §1 Belgian Code of Economic Law.

3. Use of artificial intelligence to improve the efficiency of the selection process for companies in difficulty

As discussed in Section 2.2, not all companies flagged in the KNICLI database result in a case being opened and brought before the CCD. Instead, a selection process takes place, with each CCD adopting its own methodology and criteria, which can vary significantly.

Critics have noted that the CCD often intervenes too late³⁷ and lacks sufficient personnel and technological resources to effectively monitor the substantial volume of flagged companies.³⁸ Discussions with judges from several CCDs have raised the question of whether artificial intelligence (AI) (see Section 3.1) could assist judges and court registries in making the selection process for distressed companies more objective and efficient (see Section 3.2).

3.1 Artificial intelligence (AI)

Artificial intelligence (AI) refers to the ability of computers to perform tasks that typically require human intelligence.³⁹ These tasks range from basic operations, such as recognising images, to more complex activities, such as natural language communication (e.g. ChatGPT) and decision-making.

A key technique within the field of AI is machine learning. Machine learning focuses on building models based on one or more algorithms, allowing a computer to learn and adapt to new data without being explicitly programmed. The computer achieves this by identifying patterns in large datasets. For example, a computer can learn to recognise a cat in an image by being shown numerous images of cats. By detecting patterns within those images, the computer can subsequently identify cats in previously unseen images.

37 Yves Brulard, 'Le débiteur est-il le futur créancier ? Un nouveau paradigme pour le droit de l'insolvabilité pendant et après la crise du coronavirus' in Emeline Huvelle (ed.), *L'entreprise en difficulté, ses dirigeants et ses créanciers* (Anthemis 2020), para 21.

38 Pierre-Yves de Harven, Jean-Benoît Hubin, Martin Marinx and Damien Philippot, 'La chambre des entreprises en difficulté : un "couteau suisse" au service des entreprises en difficulté et de leurs créanciers' in Frédéric Georges and Florence George (eds), *Varia en droit de l'insolvabilité* (Anthemis 2022), para 30.

39 More broadly, the field of artificial intelligence is concerned with understanding and building intelligent entities – machines that can compute how to act effectively and safely in a wide variety of novel situations. See Stuart Russell and David Norvig, *Artificial Intelligence: A modern approach* (4th ed. Pearson 2021), 1.

The development of a machine learning model involves selecting one or more algorithms, depending on the specific task, and training and testing them on the available data. There are different types of machine learning, including supervised and unsupervised machine learning.⁴⁰ *Supervised machine learning* relies on labelled data, where each data point is paired with an explicit label indicating its category (e.g. whether or not an image contains a cat). From this labelled data, the algorithm learns to make predictions about previously unseen data. *Unsupervised machine learning*, by contrast, works with unlabelled data. In this case, the algorithm detects patterns or structures in the data and organises it into clusters or groups without predefined labels. For instance, some banks use AI-based clustering to categorise their customers based on their financial behaviour and creditworthiness, enabling more targeted risk assessments and personalised financial services.

AI, particularly through machine learning, offers significant potential for enhancing processes that require the analysis of large volumes of data, such as the CCD's selection process. By identifying patterns and trends within complex datasets, AI could help streamline operations, reduce workload, and ensure timely intervention in cases of financial distress.

3.2 Use of AI for the selection of companies in difficulty

The current process of selecting companies in financial distress for investigation by the CCDs is manual, time-consuming and often inconsistent, as it relies on varying criteria set by individual judges. To address these challenges, we are currently working on a pilot project at the Commercial Court of Antwerp to develop an AI model to assist judges in this selection process.

Using machine learning techniques, the AI model will be trained and tested using historical data on companies in the KNICLI database (inputs) and the subsequent decisions made by the CCD regarding the selected companies (e.g. closure of the case, initiation of an investigation, referral for bankruptcy or dissolution (labels) – see Sections 2.2 and 2.3). The goal is to develop an AI model that assists the CCD in the selection of companies to be reviewed, by ranking them according to urgency and providing an indication of the likely decision of the CCD (e.g. referral for bankruptcy, initiation of an investigation, request for additional information, etc.).

While the AI model aims to increase the objectivity and efficiency of the selection process, its recommendations will remain non-binding. Judges will retain full discretion to accept, modify or reject the AI-generated proposals. They may choose to

40 Tom Taulli, *Artificial Intelligence Basics. A Non-Technical Introduction* (Apress 2019) 50-53.

investigate companies not selected by the model or decide not to pursue cases that the model has identified. The model will serve purely as a decision-support tool, with ultimate responsibility for decisions remaining with the CCD judges.

The AI model will be designed exclusively for internal use within the CCD, ensuring the confidentiality of the sensitive data involved. Access will be restricted to judges and the court registry, which guarantees the secure handling of data on companies flagged in the KNICLI database.

By leveraging machine learning techniques, the AI model aims to optimise the selection process, allowing judges to allocate their resources to the most critical cases without compromising their autonomy or decision-making authority.

3.3 Compliance with the AI Act

In addition to the technical challenges involved in building an AI model for use in a judicial context, the project also raises important legal and ethical questions. A key issue concerns the model's compliance with the recently adopted European Artificial Intelligence Act (AI Act).

The AI Act⁴¹ introduces the EU's first comprehensive legal framework for AI systems across various sectors and applications. Its main purpose is to promote trustworthy AI, to ensure the protection of health, safety and fundamental rights, and to support innovation.⁴² The AI Act adopts a risk-based approach, meaning that the obligations imposed on AI providers and deployers depend on the level of risk the system poses to health, safety or fundamental rights of natural persons.

At present, our team is developing an AI model using machine learning techniques. This model, still in the research phase, is designed to assist the CCDs in prioritising companies for review based on the red flags of the KNICLI database. For practical deployment, however, the model would need to be embedded in an AI system, meaning a software application in which the model is integrated and which generates outputs that support the CCDs in selecting financially distressed companies.

According to Article 3 (1) AI Act, an AI system is "a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit

41 Regulation (EU) 2024/1689 of the European Parliament and the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) [2024] OJ L 2024/1689.

42 Article 1(1) AI Act.

adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments.” The AI system that would result from integrating our model into a functional tool generating non-binding recommendations for selecting financially distressed companies, clearly falls within this definition.

The system we envisage would not fall within any of the prohibited AI practices listed in Article 5 AI Act, such as social scoring⁴³ and manipulative and deceptive techniques.⁴⁴ However, it may potentially be classified as a high-risk AI system under Article 8 (a) of Annex III AI Act, which includes AI systems “used by a judicial authority (...) in researching and interpreting facts and the law and in applying the law to a concrete set of facts (...)”. If classified as high-risk, the system would be subject to strict compliance requirements, including obligations related to data governance⁴⁵, risk management⁴⁶, human oversight⁴⁷, and transparency.⁴⁸

However, not all AI systems used in judicial contexts are automatically high-risk. Article 6 (3) AI Act provides an important exception: systems listed in Annex III are not considered high-risk if they do not pose a significant risk of harm to the health, safety, or fundamental rights of natural persons. In particular, this may be the case where the AI system is intended to perform a purely preparatory task.⁴⁹

The model developed for this project (and any future AI system based on it) is intended solely as an internal decision-support tool for CCD judges. It does not produce binding outcomes, nor does it influence decisions without human review. Whether the AI system that may ultimately result from this project qualifies as a high-risk system or falls within the exception under Article 6 (3) AI Act requires further analysis.

For now, however, the compliance obligations of the AI Act do not yet apply. According to Article 2 (8) AI Act, the Act does not apply to research and development activities prior to deployment, provided that these activities are not conducted under real-world conditions.

43 Article 5(1)(c) AI Act.

44 Article 5(1)(a) AI Act.

45 Article 10 AI Act.

46 Article 9 AI Act.

47 Article 14 AI Act.

48 Article 13 AI Act.

49 Article 6 (3) (b) AI Act.

4. Pilot project at the Commercial Court of Antwerp

For our pilot project, we selected the Antwerp Division of the Commercial Court of Antwerp as our partner. As the largest city and economic hub of Flanders (the Dutch-speaking region of Belgium), Antwerp provides a highly relevant setting for this initiative. While the strong interest of the court's judges in our project played a role in the selection, the primary factor was that the Antwerp CCD is by far the most active user of KNICLI.⁵⁰ As outlined in Section 2.1, KNICLI is a digital database containing key red flags for companies in financial distress, making it a valuable source of data for the development of our AI model.

4.1 Data collection

4.1.1 Dataset

The development of an AI model requires extensive and structured data.⁵¹ Before the start of our pilot project, the Antwerp CCD did not systematically record data related to the selection of financially distressed companies or the decisions made by the CCD regarding these companies. However, starting from March 2023, the judges and court registry staff adjusted their workflows to facilitate the systematic collection of a dataset, including:⁵²

- **Data on companies flagged in KNICLI:** All data contained in KNICLI for companies listed in the database.
- **Data on selected companies:** An overview of companies selected for CCD review.
- **Data on companies immediately referred for bankruptcy or dissolution upon selection:** An overview of the companies that are immediately referred for bankruptcy or dissolution proceedings by the CCD president.
- **Data on decisions of the CCD:** These decisions are recorded in the CCD's session minutes, which are systematically prepared and maintained by the court registry.

To ensure the confidentiality of data concerning financially distressed companies, all the collected data are pseudonymised. This process involves replacing each company's identification number with a hash, i.e. a randomised sequence of characters that allows the system to recognise recurring entries without revealing the original

50 In the first year of KNICLI's implementation (starting in September 2021), two-thirds of all consultations of the KNICLI database were conducted by the Antwerp CCD. See Hans Van den Nieuwenhof, 'De opsporing van ondernemingen in moeilijkheden' in Herman Braeckmans, Stan Brijs, Henri Colman and Miet Debucquoy (eds.), *Faillissement en reorganisatie* (Kluwer, 2023), para 59; Ivan Verougstraete, *Manuel de l'insolvabilité de l'entreprise* (Kluwer 2019) 49, footnote 1.

51 Tom Taulli, *Artificial Intelligence Basics. A Non-Technical Introduction* (Apress 2019) 19-38.

52 The data collection process was preceded by intensive preparation. A GDPR Register and a Data Collection Protocol were drafted, and discussions were held with the project manager of the KNICLI database as well as the IT department of the Belgian College of Courts and Tribunals.

identifiers. Additionally, noise is applied to financial data, such as outstanding social security or VAT debts, to prevent the indirect identification of companies based on specific amounts. The entire pseudonymisation takes place within the court, ensuring that researchers only have access to the pseudonymised data for the development of the AI model. This approach safeguards the confidentiality of sensitive information while still allowing for the development of a robust AI model.

4.1.2 Limitations of the data collection

Despite the progress made in systematic data collection, several limitations persist. While KNICLI contains the most critical red flags, it does not cover all potential indicators of financial distress (see Section 2.1). In practice, CCDs sometimes initiate an investigating based on red flags that are not included in KNICLI, such as fictitious company seats. However, data on the red flags not included in KNICLI are currently not recorded in a digital and systematic manner, making their systematic inclusion in the dataset practically unfeasible.

Another limitation is the selection bias inherent in KNICLI itself, as this database only contains data of companies that have triggered at least one red flag. Ideally, the dataset would also contain data from financially healthy companies that show no signs of distress. Including such companies would provide a more balanced and representative sample, allowing the model to better distinguish between healthy and distressed companies and thereby improve its predictive performance.

A second form of selection bias results from the current manual selection process. Data on case outcomes are only available for companies that are manually selected by the court registry, not for all companies flagged in KNICLI. This means that for companies in KNICLI that were not selected for investigation by the CCD, no outcome data exist. While most of these cases can be presumed to have no urgent financial distress, it would be valuable to identify those companies that currently escape manual detection but are actually at risk.

Furthermore, when deciding on cases, the CCD considers not only KNICLI data but also additional information revealed during the investigation, such as financial data from annual accounts. However, due to practical constraints, collecting and incorporating this additional information into the dataset was not feasible at this stage.

Documentation practices further limit data completeness. At the Antwerp CCD, a large number of the selected cases are handled directly by the CCD president.⁵³ However, no data are available on the decisions made by the CCD president in these

53 The Antwerp CCD has two presidents, who preside the CCD in turn.

cases, except for immediate referrals for bankruptcy or dissolution (see Section 2.2). As a result, the session minutes of the CCD only cover decisions made by the full CCD, excluding those handled directly by the CCD president.

Finally, the data collection remains a manual process, relying on the cooperation of court staff and the proper functioning of the KNICLI database. This dependency became apparent during a technical disruption of the KNICLI database between May and August 2024, which temporarily hindered data extraction.

These limitations highlight the need for further refinements to the data collection process and the technical infrastructure supporting it. Nevertheless, the collected data provide a solid basis for the exploration of the development of our AI model.

4.2 Preliminary results

4.2.1 Description of the collected data

One year after the start of data collection, we began exploring the development of an AI model to assist the CCD in selecting companies in financial distress. During the first year of data collection (March 2023–February 2024), the KNICLI database recorded a total of 9,657 unique companies in the Antwerp region. Of these, only 610 companies (6.3%) were selected for investigation by the CCD (see Figure 1).

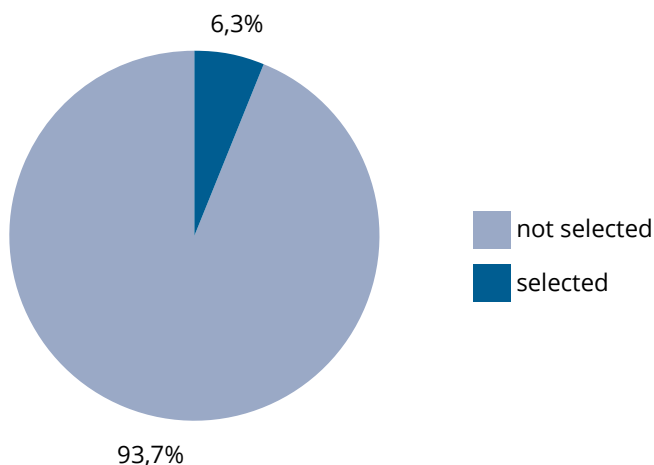


Figure 1 Selection by CCD Antwerp

After data cleaning, we identified a total of 2,869 CCD decisions from the CCD's session minutes and the lists of companies immediately referred for bankruptcy or dissolution upon selection (see Section 4.1.1). These decisions involved 1,741 unique

companies,⁵⁴ with several companies appearing in multiple CCD decisions during the studied period. As previously noted, it frequently occurs that a company's file is reviewed multiple times in succession by the CCD.

Figure 2 shows the distribution of the 2,869 decisions made by the CCD. A substantial portion of the cases – 27.0%, representing 776 decisions – were closed because the company was not or was no longer in financial distress (see Sections 2.1 and 2.2, *Closure of the Case*). Additionally, 5.4% of cases, or 155 decisions, were closed because the company had already been declared bankrupt during the investigation.

In 41.9% of cases, amounting to 1,203 decisions, the CCD opted to continue investigating the company. Within this category, 621 decisions (21.6%) involved scheduling the case for future review (see Section 2.2, *Deferral for Re-evaluation*). Another 561 decisions (19.6%) resulted in requests for additional information from the company (see Section 2.2, *Request for Additional Information*). Only a small fraction of cases, 21 decisions (0.7%), were referred to the president of the CCD to determine whether a provisional administrator should be appointed (see Section 2.3, *Appointment of a Provisional Administrator*).

Approximately 23.3% of cases, equating to 669 decisions, resulted in referring the company for bankruptcy or dissolution. Of these, 320 cases were referred to the public prosecutor for bankruptcy proceedings (see Sections 2.2 and 2.3, *(Immediate) Referral for Bankruptcy*), with 35 of these referrals made immediately after the company was selected. Similarly, 349 cases were referred to the dissolution chamber (see Sections 2.2 and 2.3, *(Immediate) Referral for Dissolution*), with 213 referrals occurring immediately after selection.

A small number of cases – 18 in total – were closed for other reasons, such as the relocation of a company's registered office. For 48 cases, the decision outcome was unknown due to incomplete or unavailable data.

54 This number is higher than the number of selected companies between March 2023 and February 2024, since the decisions also involved previously selected companies.

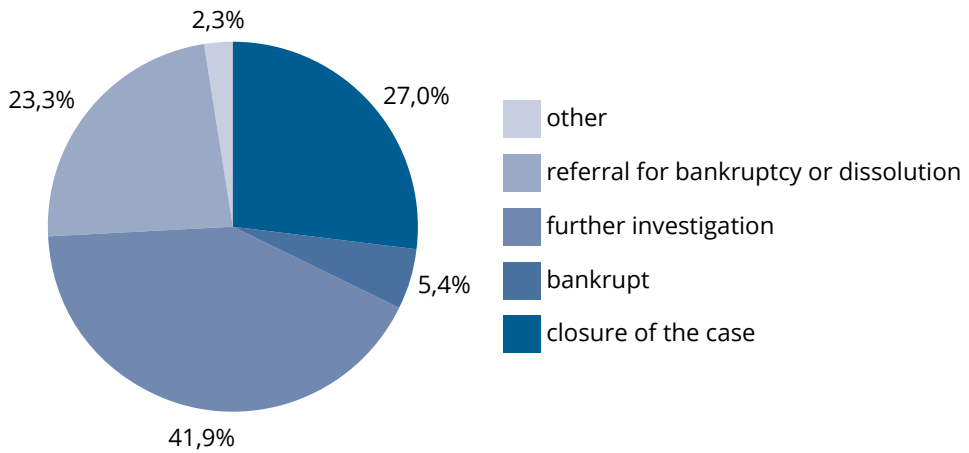


Figure 2 Decisions by CCD Antwerp

The data show that only a small fraction of companies flagged in KNICLI are selected for investigation, reflecting the CCD's need to prioritise limited resources. Furthermore, the recurrence of certain companies highlights the iterative nature of the CCD's decision-making process.

These findings provide valuable input for the development of the envisaged AI model, which aims to enhance the efficiency of the selection process by identifying patterns in historical CCD decisions. Future refinements in data collection, particularly regarding the frequency of a company's reappearances and the currently unknown decision outcomes, will be crucial for improving the model's predictive accuracy and practical usefulness.

4.2.2 AI model exploration

The goal of our pilot project is to develop an AI model that assists the CCD in selecting companies for review by ranking them according to urgency and providing an indication of the likely CCD decision (e.g. referral for bankruptcy, initiation of an investigation, or request for additional information) (see Section 3.2). With this AI model, we aim to enhance the efficiency and consistency of CCD decision-making while reducing the workload for judges and court registry staff.

Although the dataset collected to date is not yet sufficient to build a fully effective model, we have begun exploring a model aligned with our ultimate objective, with a specific focus on the CCD's regulatory task. Specifically, this preliminary model seeks to predict the probability that a company selected for CCD review will either be referred for bankruptcy or dissolution proceedings or will go bankrupt during the

CCD's investigation. By generating probabilistic predictions, the model produces a ranked list of companies, prioritising those most likely to face bankruptcy or dissolution. If implemented, this model could enable the CCD to focus its regulatory efforts on the companies most at risk, ensuring timely intervention where it is most urgently needed.

It is essential to emphasise that the AI model will serve solely as a decision-support tool, with its recommendations remaining non-binding. If a company is selected by the model and the CCD decides to open a case, the company will have the opportunity to challenge its selection. In line with standard CCD practice, the company will be invited to submit additional information on its financial situation or to appear before the CCD for a hearing. During this process, the company will have the opportunity to contest its selection or the predicted outcome suggested by the model. The final decision will rest exclusively with the CCD judges, thereby ensuring that procedural fairness and due process are upheld (see also Section 3.2).

5. Conclusion and future work

The integration of artificial intelligence (AI) into judicial decision-making is gaining momentum. This paper has explored the potential of AI to support the Chambers for Companies in Difficulty (CCDs) within Belgian commercial courts in selecting financially distressed companies for investigation. Given the substantial number of companies with red flags of financial distress and the limited resources available to CCDs, AI offers an opportunity to enhance both the efficiency and the objectivity of the selection process.

Our research points out that the current manual selection process varies across CCDs, lacks standardisation, and imposes a significant burden on judges and court registry staff. By leveraging historical CCD decisions and red flag indicators from the KNICLI database, AI models can help to streamline this process. Specifically, our pilot project at the Commercial Court of Antwerp focuses on developing an AI model that ranks companies from the KNICLI database by risk level, allowing courts to prioritise cases that require urgent intervention.

However, it is crucial to emphasise that the AI model is designed solely as a decision-support tool, not as an autonomous decision-maker. The final responsibility for selecting and investigating companies must remain with CCD judges, who will evaluate the AI-generated recommendations and make the ultimate decisions based on their legal expertise and the assessment of the specific situation of the company.

Despite the promising preliminary findings of our pilot project, several challenges remain. A key limitation is availability of data⁵⁵, particularly regarding financial information from annual accounts. Future research will focus on integrating such data into the model, as previous studies have shown that financial ratios extracted from annual accounts significantly improve the predictive power of bankruptcy models.⁵⁶ Additionally, we aim to expand the dataset by establishing partnerships with other Belgian CCDs, thereby improving the model's representativeness and robustness.

Furthermore, we plan to conduct an in-depth evaluation of the model in collaboration with CCD judges to assess its practical utility and accuracy. This evaluation will include feedback sessions to identify strengths and areas for improvement. Additionally, a prospective study will be conducted to measure the model's effectiveness in practice, comparing outcomes with and without AI assistance.

Another critical area for future research concerns the legal and ethical standards that the AI model must meet if implemented. A key challenge will be ensuring compliance with the recently adopted European AI Act, which imposes strict requirements for transparency, accountability and fairness in high-risk AI applications, including judicial decision-support systems.

Ultimately, this research highlights AI's potential as a transformative tool in insolvency proceedings. While AI cannot – and should not – replace judges, it can serve as a valuable aid in detecting and selecting financially distressed companies, enabling courts to intervene more effectively and allocate their limited resources where they are most needed. With further refinements in data collection and model development, AI could contribute to a more stable and efficient economic system by facilitating timely detection of and support for financially distressed companies or, when recovery is no longer feasible, their orderly removal from the market.

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55 Another limitation concerns red flags not currently included in KNICLI. As long as such indicators of financial distress are not systematically and digitally recorded, their integration in the model remains infeasible.

56 Apostolos Dasilas and Anna Rigani, 'Machine learning techniques in bankruptcy prediction: a systematic literature review' (2024) 255 *Expert Systems with Applications* 124761.