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AMP | Optimizing M&A Outcomes: Harnessing the Power of Big Data Analytics and Natural Language Processing

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Abstract

Mergers and Acquisitions (M&A) transactions are complex, involving multiple stakeholders and time-consuming manual processes. In this paper, we introduce Accelerated M&A Processes (AMP), a protocol that leverages machine learning and data mining to automate key aspects of M&A, including legal, valuation, company identification, financials, and due diligence. Additionally, this paper will go into several successful case studies of AI (artificial intelligence) being used in M&A transactions, especially due diligence, along with interviews featuring Simplilearn (backed by the Blackstone Group) CEO, Krishna Kumar (2023), Generational Equity Senior Vice President of M&A, Amy Wall (2023), and University of Central Florida Assistant Professor of Finance, Buvaneshwaran Venugopal (2023), all discussing the challenges and the future with traditional acquisition processes. This whitepaper also delves into AMP's technical underpinnings, while also comparing the duration and outcomes of traditional M&A methods with AMP's efficient deal-making procedures.

Keywords: Mergers and acquisitions, Artificial Intelligence, Machine learning, Data mining

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1. Introduction

1.1. History of M&A: Traditional Dealmaking, and Financial Factors Taken into Account

For decades, firms across sectors have used mergers and acquisitions (M&A) as key strategic operations. The first signs of M&A may be seen in the early 20th century, when companies started to see the advantages of working together to develop and gain market domination. Market changes, legal frameworks, and economic situations have all had an impact on how M&A procedures have changed over time. M&A activity has historically been segmented into waves, each of which was characterized by certain traits and existing economic circumstances (Census Bureau, 1970).

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First Wave (1897-1904): Characterized by horizontal mergers for industry consolidation, leading to monopolistic trusts like Standard Oil and US Steel.

Second Wave (1916-1929): Defined by vertical mergers to control supply chains, inspired by advances in communication and transport (Ching, 2019) but ended with the 1929 market crash.

Third Wave (1965-1969): Involved conglomerate mergers for diversification and risk management, also marked by the onset of hostile takeovers.

Fourth Wave (1981-1989): Introduced leveraged buyouts (LBOs) and junk bond financing; it ended with the 1987 stock market crash.

Fifth Wave (1992-2000): Driven by globalization and technology, focusing on cross-border M&A and digital economy, halted by the dot-com bubble burst.

Sixth Wave (2001-2008): Dominated by private equity firms using LBOs, abruptly ended by the 2008 financial crisis.

Seventh Wave (2009-present): Focuses on strategic acquisitions in technology and faces increased regulatory scrutiny and activist shareholder influence (Ching, 2019).

1.2. Eighth Wave (To Be Decided): The AI-Driven and Machine Learning Era

The eighth wave of Mergers and Acquisitions (M&A) is poised to witness a profound transformation driven by the widespread adoption of Artificial Intelligence (AI) technologies. This wave, however, is distinct from its predecessors. While previous waves were characterized by the types of companies involved or the business decisions made, this wave is defined by a fundamental shift in the way M&A is conducted, driven by the integration of AI, Natural Language Processing (NLP), machine learning, predictive analytics, and other advanced tools.

In this wave, we anticipate seeing a surge in non-tech companies acquiring AI companies that are developing tools to enhance their operations. For instance, a logistics company like FedEx might acquire an AI-based scheduling company to optimize their shipment analysis and scheduling. This trend mirrors the dot-com-motivated M&As and those that followed the introduction of Cloud Computing by AWS, where companies sought to leverage new technologies to drive their business forward (Venugopal, 2023).

AI and NLP, in particular, hold immense potential to enhance various stages of the M&A process. During the due diligence phase, NLP can leverage its capabilities to swiftly analyze and process vast volumes of unstructured data, including legal documents, financial reports, and emails. This accelerated data processing will not only expedite the due diligence process but also contribute to more accurate assessments, leading to well-informed investment decisions.

Machine learning techniques will also play a crucial role in forecasting M&A outcomes. By analyzing past transactions, current market circumstances, and company-specific data, machine learning algorithms can produce more accurate forecasts about the likelihood of a merger or acquisition. These insights will enable decision-makers to make strategic decisions that align with their objectives.

In essence, the eighth wave of M&A represents a new era where AI technologies are not just a part of the deal but are driving the deal-making process itself. This wave is set to revolutionize traditional M&A practices and reshape the landscape of corporate acquisitions.

Moreover, the financial modeling component of M&A is about to undergo a revolution thanks to AI technology. Leveraged buyout (LBO) and Discounted Cash Flow (DCF) models are two examples of financial models that may be streamlined and improved using advanced AI algorithms to increase accuracy and dependability. These models may include knowledge from historical data, market dynamics, and sector trends by utilizing machine learning techniques, leading to more reliable assumptions. The development of these financial models may also be accelerated by AI-driven automation, allowing for real-time changes and reducing the possibility of human mistake.

AI can also significantly contribute to post-merger integration. AI algorithms can effectively identify areas of overlap and redundancy within the merged entity, optimizing resource allocation and enhancing

operational efficiency. Additionally, these algorithms can contribute to cultural assimilation efforts by identifying potential clashes and suggesting strategies to address them, thereby fostering successful integration.

The eighth wave of M&A is also likely to witness an increased focus on Environmental, Social, and Governance (ESG) factors, driven by the global impetus for sustainability. AI can play a crucial role in measuring and tracking a company's ESG performance as accurately, which will significantly influence its valuation and attractiveness in an M&A context. By integrating AI tools, organizations can more effectively assess the ESG impact of a potential target, enabling responsible decision-making and contributing to long-term value creation (Ching, 2019).

As markets continue to evolve and new challenges emerge, the strategic motivations and financial consideration driving M&A will continue to evolve as well, establishing a dynamic and adaptive framework for future mergers and acquisitions.

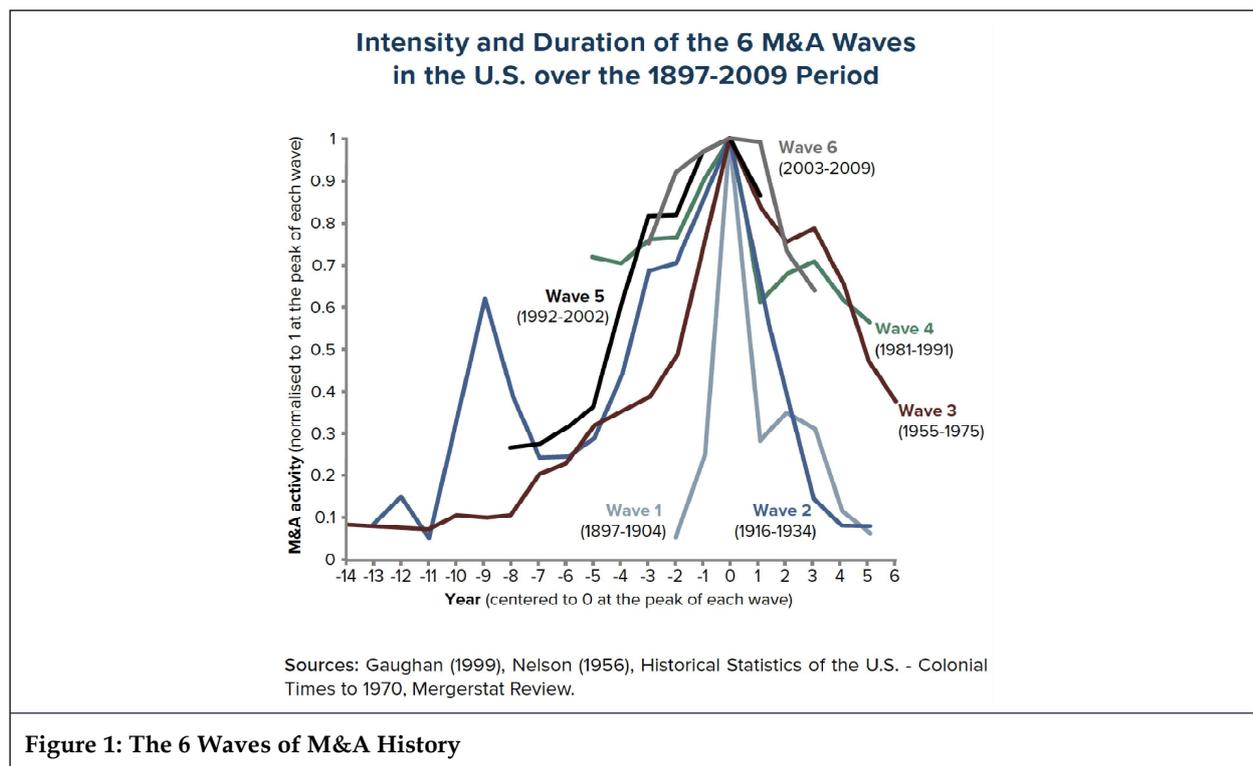


Figure 1: The 6 Waves of M&A History

2. Challenges and Limitations of Traditional Deal Making: A Discussion with Simplilearn Founder and CEO - Krishna Kumar

Traditional Mergers and Acquisitions (M&A) deal making procedures frequently encounter a number of obstacles and constraints that might compromise effectiveness and results. The difficulty of maintaining enormous volumes of data and documents, the requirement for labor-intensive manual analysis, and the possibility of human error are the root causes of these difficulties. These restrictions may cause delays, higher expenses, and lost opportunities. To solve these issues and change the M&A market, new technologies such as Natural Language Processing (NLP) are emerging.

The time and effort needed for document examination is one of the main problems with traditional dealmaking. M&A transactions entail a large number of legal agreements, financial records, reports from the due diligence process, and other documents that must be carefully read and examined. This manual method takes a lot of time and is prone to mistakes or negligence. It might be difficult to properly extract information, which can cause delays and higher expenditures.

Traditional dealmaking also frequently has trouble appropriately gauging market perception and emotion. Making educated judgments throughout the M&A process requires a thorough understanding of stakeholder reactions, industry trends, and public opinion. However, depending exclusively on arbitrary judgments or scant data might lead to inaccurate and insufficient results. Traditional approaches could find it difficult to

fully capture market dynamics and emotions, which could result in misunderstandings or the failure to notice important information.

Additionally, the ability of conventional dealmaking procedures to effectively handle and organize knowledge may be constrained (Kumar, 2023). For decision-making and due diligence, M&A professionals rely on having access to pertinent information, historical data, and precedents. The sheer amount of data and the absence of appropriate search tools, however, make it difficult to use the available information effectively. Finding and removing important ideas from a sizable corpus of texts can take time and be error-prone.

In an interview with Krishna Kumar, CEO and Founder of Simplilearn, an EdTech firm backed by the Blackstone Group and one of the world's leading providers of online training, we discussed the limitations that often occur in deal making and merger processes, by specifically mentioning tedious M&A components of an entire transaction and their recent acquisition of Fullstack Academy.

When asked about the potential benefits of deriving insights from unstructured data, Kumar expressed the following opinion: "I would say unstructured data is more external for us. It takes a lot of time and effort. Unless you are a very big company with time and resources, gaining valuable insight from unstructured data can be a very difficult process" (Kumar, 2023).

Kumar's response highlighted the challenges associated with unstructured data analysis. He emphasized that for companies like theirs, which primarily relied on structures and explicit data such as financial statements, extracting insights from unstructured data posed significant hurdles. The time-consuming nature of the process and the need for substantial resources were cited as major factors limiting the effective utilization of unstructured data.

This viewpoint sheds light on the practical considerations that organizations may face when considering the incorporation of unstructured data into their due diligence processes. It highlights the resource-intensive nature of analyzing unstructured data and suggests that it may be more feasible for larger companies with greater time and resource availability to undertake such initiatives effectively.

Thus, it is precisely in scenarios like this that the potential of NLP and AI technologies become even more relevant. NLP and AI offer promising solutions to overcome the limitations outlined by Kumar, enabling organizations to effectively leverage unstructured data and unlock valuable insights (Kumar, 2023). By harnessing advanced NLP algorithms, companies can streamline the analysis of unstructured data, reducing the time and effort required for manual review. These algorithms can effectively process large volumes of textual data, such as contracts, customer reviews, legal documents, and internal communications, extracting key information and identifying patterns that may have otherwise gone unnoticed (Kumar, 2023). AI-powered tools can automate the extraction of insights from unstructured data sources, allowing companies to efficiently tap into external information. Machine learning models can be trained to recognize and categorize relevant data points, enabling faster identification of potential risks, opportunities, and synergies in the target company. This, in turn, improves the efficiency and accuracy of the due diligence process.

In addition, Kumar also highlighted the tedious processes that went along when his company when acquiring the New York based Fullstack Academy (Business Wire, 2022), a growing and prominent edtech firm that has similar objectives to Simplilearn, the transaction (Business Wire, 2022), as noted by Kumar, simply took months on end to review due diligence and ensure that all legal proceedings were to cause no corporate trouble in the future, this is where we see AI playing a crucial role in not only speeding up due diligence but also being able to ensure that merger transactions, as exemplified by Simplilearn acquiring Fullstack Academy, are carried out smoothly (Kumar, 2023).

Additionally, NLP and AI technologies can assist in analyzing cultural fit, a critical aspect of M&A transactions. By leveraging sentiment analysis and linguistic pattern recognition, these tools can provide objective measures to evaluate the alignment of organizational cultures, mitigating the subjective biases that may arise in traditional assessments. Furthermore, the integration of NLP and AI capabilities with structured data sources can offer a comprehensive view of the target company. By combining insights from structured financial data with unstructured information, organizations can gain a more holistic understanding of the target's performance, competitive landscape, and potential value (Kumar, 2023).

3. The Rise of Big Data Analytics in M&A: An Interview with Generational Equity Senior Vice President of M&A - Amy Wall

Our exploration into the potential of AI in M&A due diligence led us to a conversation with Amy Wall, Senior Vice President of Generational Equity, a middle-market investment bank. Wall provided intriguing insights into the nuances of the M&A process, areas ripe for AI integration, and also the limitations inherent in this complex field.

Wall began with a stark reminder of a lesser-known fact in M&A — “only a small fraction of businesses on the market actually end up selling” (Wall, 2023). Profitability, while crucial, isn’t sufficient to ensure a sellable business. Factors such as owner dependency, high customer concentration, operating in a waning industry, and mismatched seller expectations, often impede the selling process.

The interplay between these dynamics and the potential role of AI is intriguing. AI could help business owners ascertain their firm’s value, offering a realistic assessment to align their expectations with market realities. An AI-based system like AMP could, theoretically, analyze data trends, industry norms, and company-specific metrics to provide a more accurate valuation range, addressing one key hurdle in the M&A process.

A critical limitation in the current M&A process, according to Wall, is the difficulty of making the right buyer-seller connections. She noted, “There are limitations in contacting potential buyers — hard to find contact information although there are databases that provide this as a service and it has improved tremendously. Matching buyers and sellers is a challenge — we meet with Private Equity Groups (PEGs) on a regular basis. They often have very specific requests as add-on opportunities. We get so many requests and have so many clients it can be overwhelming to remember when a new deal comes on the market who may have requested that type of firm” (Wall, 2023).

Wall’s insight throws light on the logistical challenges inherent in the M&A process, particularly around connecting potential buyers and sellers. The data glut from multiple sources, the specificity of PEGs’ requirements, and the sheer volume of incoming requests can lead to a significant bottleneck in matching suitable parties. The situation she described — a failure to remember specific PEG requests for educational technology companies when such a firm became available — illustrates the critical need for an efficient matching system (Wall, 2023).

Incorporating AI systems like AMP to streamline the process of matching buyers and sellers could potentially mitigate this challenge. AMP could be designed to handle vast amounts of data, tracking and recording buyer requirements and automatically correlating them with new market entries. This intelligent matching process could alleviate the overwhelming task of manually connecting requests with market availability, significantly enhancing the M&A process’s efficiency and success rate.

Reflecting on the potential of AI in M&A, Wall shared an anecdote about how AI enabled her to quickly identify potential buyers for a client who owns a pilot training school. An AI system was able to generate a list of relevant colleges and universities that provide similar programs, bypassing hours of tedious manual research. This scenario illustrates the transformational power of AI in speeding up and refining the buyer identification process, a key aspect of our AMP protocol.

Despite these promising opportunities, Wall maintains a pragmatic outlook about the limitations of AI. Drawing on her extensive experience, she highlighted that deals often fall through not because of the due diligence process itself, but the content it uncovers. Discrepancies in financials, underperformance against projections, and buyer suspicion can jeopardize deals. Wall does not see AI fundamentally altering this reality for M&A professionals. However, she did muse on the possibility of AI helping business owners better understand when their earnings are at risk, reinforcing the multifaceted potential of AI to both improve the due diligence process and aid business owners.

Lastly, Wall provided a glimpse into the future. Generational Equity’s evaluation team is experimenting with AI for valuation, bringing AI’s potential full circle — from identifying potential deals to the final valuation process. This experimentation underscores the growing acceptance of AI in this traditionally human-driven domain and brings us back to the central premise of our research: AMP and similar AI-based solutions have the potential to revolutionize the M&A landscape.

This interview with Amy Wall underscores the potential of AI in M&A transactions, specifically in the due diligence process. While it highlights several areas ripe for AI integration, it also serves as a valuable reminder of the limitations and intricacies inherent in the M&A process. As we further develop the AMP protocol, these insights will be invaluable in guiding our efforts to make the due diligence process more efficient and effective.

4. Streamlining the Financial World: An Interview with Buvaneshwaran Venugopal - Ast. Professor of Finance (University of Central Florida)

We had the privilege of interviewing Professor Buvaneshwaran Venugopal, an Assistant Professor of Finance at the University of Central Florida (Venugopal, 2023). With his extensive knowledge and experience in the field of finance, particularly in the area of Mergers and Acquisitions (M&A), Professor Venugopal provided valuable insights into our project. His expertise in the integration of Artificial Intelligence (AI) and big data analytics in M&A processes has been instrumental in shaping our understanding and approach to this project. Here are the key takeaways from our enlightening conversation with him (Venugopal, 2023):

Q1: How can we further improve the AMP protocol to make it more efficient and effective, particularly for the due diligence portion regarding M&A transactions?

Professor Venugopal: The AMP protocol you explained in the paper would need immense technical training. But in general, training on the context-specific corpus, human validation, and training the model to distinguish the differences between M&As in different industries are vital. For instance, BioTech/Pharma M&As are characterized by high levels of debt financing while High-tech deals may be financed by equity. The former may be more within the industry while the latter cross-industry. In other words, the industry classification of M&A deals is an important factor and will have a lot of information. While due diligence of deals is an obvious pain point, deal scouting is where I believe there is a lot more to be done with the help of AI, and will have a major impact on investment banks.

Q2: What are the potential ethical considerations when using AI and big data analytics in M&A?

Professor Venugopal: The concept of who owns customer data is a tricky question in the US. GDPR in Europe is a step in the right direction. Ownership needs to be established before we can talk about other issues.

Q3: What are some limitations to consider for the current M&A process? What are your thoughts on the overall M&A process right now?

Professor Venugopal: The entire M&A process is long and can take up to 2 years in some cases. Yes, some of it can be sped up with AI but the tedious part may also be deliberate. Companies need time to evaluate customer/market reaction. Plus, the level of nuance in the deal structuring and contracting (e.g., earnout clauses) is tremendous and there will be a need for human input despite advances in technology because at the end of the day M&As are all about two parties negotiating for a better deal.

Q4: In M&A classes at Universities, should artificial intelligence be added as a requirement or skill needed to compete in the class?

Professor Venugopal: I believe that programming skills are absolutely necessary for everyone to function in the near future. However, M&A classes are not the correct avenue for learning tech skills because there is a lot of business knowledge to be covered there. Having said that, M&A classes could be a place where students are informed of new tools like Document Intelligence.

Our conversation with Professor Venugopal, provided us with valuable insights into the integration of Artificial Intelligence (AI) and big data analytics in the M&A process. His perspectives have significantly enriched our understanding of this complex field and will undoubtedly inform our ongoing work on the AMP protocol.

Professor Venugopal highlighted the potential of AI and big data analytics to revolutionize the M&A process, particularly in the areas of due diligence and deal scouting. He emphasized the importance of training AI models on context-specific corpora and validating their outputs with human expertise. He also pointed out the need for these models to distinguish between M&As in different industries, as the characteristics of these deals can vary significantly (Venugopal, 2023).

In addition to Professor Venugopal's insights, it's worth considering other perspectives that relate to the use of AI in M&A. For instance, some experts argue that while AI can significantly speed up the due diligence process and enhance deal scouting, it's equally important to consider the human element in M&A. Negotiations, relationship building, and understanding the cultural fit between companies are aspects that still heavily rely on human judgment, this would be a factor that is crucial to consider when developing a proposed solution like AMP.

Moreover, while Professor Venugopal brought up the complex issue of data ownership, particularly in the US context, it's also crucial to consider the broader implications of data privacy and security in M&A. As companies increasingly rely on AI and big data, ensuring the protection of sensitive information becomes paramount (Venugopal, 2023). This is especially relevant in cross-border M&A, where differing data protection laws can pose additional challenges.

Finally, on the topic of education, Professor Venugopal expressed his belief that tech and programming skills are essential for everyone in the near future. However, he suggested that M&A classes at universities might not be the best place to learn these skills due to the extensive business knowledge that needs to be covered (Venugopal, 2023). This raises an interesting question about the future of business education and the balance between technical skills and industry-specific knowledge in the near future.

In conclusion, our conversation with Professor Venugopal, along with these additional perspectives, underscores the transformative potential of AI and big data analytics in the M&A process. As we continue to explore this field, these insights will guide our understanding and approach to the AMP protocol

5. Leveraging Natural Language Processing (NLP) for Streamlining M&A Processes

Textual data plays a large role in the M&A process, encompassing a wide range of sources such as financial reports, legal documents, due diligence reports, market research, news articles, and more. Traditionally, extracting meaningful information from this unstructured textual data has been a labor-intensive and time-consuming task. Yet, with the advent of NLP techniques, organizations now have the ability to process and analyze this textual data at scale. As organizations seek to streamline and optimize the M&A process, NLP emerges as a powerful tool for extracting meaningful insights from vast amounts of textual data.

The integration of NLP in the M&A process addresses a critical challenge-making sense of the enormous volume of textual information that accompanies M&A transactions. From legal contracts and due diligence reports to industry news and customer reviews, there is an overwhelming amount of unstructured data that holds valuable insights. NLP algorithms, powered by machine learning and linguistic analysis, can efficiently process and interpret this textual data, enabling organizations to gain actionable intelligence. Additionally, by applying NLP techniques, organizations can automate tasks such as document classification, information extraction, sentiment analysis, and entity recognition. This automation accelerates the due diligence process, reduces manual effort, and enhances the accuracy and consistency of information retrieval. Moreover, NLP enables the extraction of key facts, relationships, and trends from textual data, providing a comprehensive understanding of the target company's operations, market perception, and potential risks.

Another significant benefit of NLP in M&A is its ability to facilitate efficient knowledge management and information sharing. With the vast amount of textual data generated during the M&A process, capturing, organizing, and accessing relevant information becomes a complex task, NLP-powered solutions can assist in creating searchable databases, and generating real-time insights, ensuring that stakeholders have access to the right information at the right time. More importantly, NLP-driven sentiment analysis can uncover valuable insights from customer feedback, social media discussions, and online reviews, shedding light on the target company's brand perception, customer satisfaction, and potential risks or opportunities. This information can play a crucial role in evaluating the compatibility and potential challenges associated with the merger or acquisition.

The integration of NLP into the M&A process is not without its considerations, however. Organizations must address challenges related to data privacy, language nuances, and the need for robust NLP models capable of expertise and analysis. Still the benefits of NLP in streamlining the M&A process, improving decision-making, and accelerating deal execution make it an extremely compelling technology to embrace.

Siddharth Yadunath on Leveraging AI-Powered Tools - Integrating Simplilearn Products with Fullstack Academy's Workshops: The product team has faced a distinct set of difficulties and possibilities as a result of the integration process between Simplilearn and Fullstack Academy. Siddharth Yadunath (2023) calls attention to one particular way that Fullstack Academy enhances its organized upskill courses: workshops. "FSA (Fullstack Academy) has a fixed structure with which they create their courses, and one of the components that they have and we don't are their workshops," Siddharth adds. Since Simplilearn's upskilling courses do not include workshops, the team has started using ChatGPT to describe the format of the workshops that will be provided by FSA (Siddharth, 2023).

To address this gap and ensure a smooth integration, the product team at Simplilearn has leveraged ChatGPT, an advanced natural language processing tool. Siddharth further elaborates on the use of ChatGPT, stating, "We have begun to use ChatGPT to outline the structure of the workshops that will be offered through FSA" (Siddharth, 2023). He emphasizes how this AI-powered tool enables the team to interact with the model, inputting specific requirements and receiving detailed responses that outline the structure and content of the workshops.

The integration of ChatGPT in the workshop outlining process has proven to be a valuable asset for the product team. It offers a scalable and efficient solution, reducing the manual effort required to develop new workshop content. Siddharth's use of ChatGPT showcases the potential of NLP and AI technologies in shaping and expanding educational programs, enabling companies to enhance their offerings and provide a more comprehensive learning experience to their students (Siddharth, 2023).

Not only does it highlight the product team's innovative approach to the integration process, but it also exemplifies the collaborative efforts undertaken by the team to ensure a successful and synergistic union between the two organizations.

By effectively utilizing AI technology, Simplilearn can capitalize on Fullstack Academy's strengths and incorporate them seamlessly into their existing framework. The integration of ChatGPT showcases how NLP and AI technologies can play a crucial role in facilitating seamless integrations and consolidating resources from different entities.

6. AMP Technical Underpinnings

6.1. Utilizing Advanced NLP Models

Our first step is to utilize state-of-the-art NLP models such as Bidirectional Encoder Representations from Transformers (BERT) and Generative Pretrained Transformer 3 (GPT-3). These models have demonstrated remarkable performance in understanding and generating human-like text, making them ideal for our needs (Davenport et al., 2023).

BERT, for instance, is a transformer-based machine learning technique for NLP pre-training. It understands the nuances of language by examining patterns in written text, from the left and the right of a word (hence, bidirectional). This allows the model to understand the context of a word in relation to all the other words in the sentence, rather than just the words that precede or follow it.

We also propose the idea of creating our own natural language model and training with enough data to be on par with advanced models on the market. We would first use tokenization techniques to convert the words into individual units. We can then convert them into vectors, which is a numerical representation of the words being analyzed. These can also be known as word embeddings. BERT Word Embeddings, Glove, or Word2Vec are very popular libraries that assist in converting the tokens into word embeddings that capture the semantic feeling of the text (Davenport et al., 2023). This will all help in creating our model as a CNN or transformer model, which are the ones related to GPT and BERT. Through the use of hyperparameter tuning we will be able to achieve a higher accuracy with the train and test datasets we use.

GPT-3, on the other hand, is a language prediction model that uses machine learning to produce human-like text. It has around 175 billion machine learning parameters and is one of the best LLM's (Large Language Model) in the market right now. GPT-3 excels at tasks that involve generating creative and complex content, making it a valuable tool for our purposes.

6.2. Domain-Specific Fine-Tuning

While these models are powerful, they need to be fine-tuned to our specific task – understanding and analyzing legal documents in M&A transactions. This involves training our models on a large corpus of legal documents, contracts, and M&A transaction data. M&A data can primarily be found through the Library of Congress, University of Pennsylvania Wharton Database, and several other trusted third party services.

Fine-tuning is a process that adjusts the weights of our pre-trained models based on the specific task at hand. This process allows us to leverage the power of these models while tailoring them to our specific needs. By training our models on legal documents and M&A data, we can ensure that they understand the unique language, terms, and structures used in these documents.

6.3. Named Entity Recognition (NER)

NER is a crucial component of our approach. It's a sub-task of NLP that seeks to locate and classify named entities in text into predefined categories such as person names, organizations, locations, medical codes, time expressions, quantities, monetary values, percentages, etc. (Nadeau and Satoshi, 2023).

In the context of M&A transactions, NER can be used to identify key entities in legal documents, such as the parties involved, contract terms, obligations, and more. This information is crucial for understanding the details of a transaction and can help us automate the process of extracting this information from legal documents.

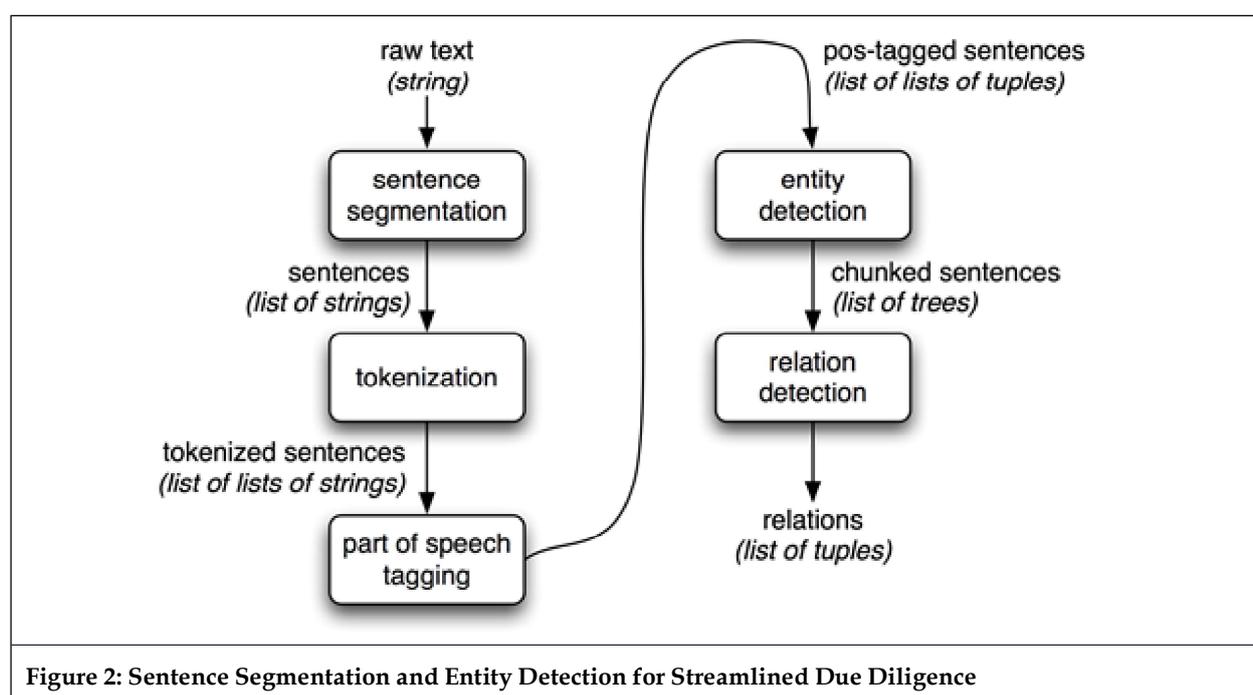
6.4. Information Extraction and Summarization

Once our models can understand and identify key entities in the documents, the next step is to extract this information and present it in a structured, easy-to-understand format. This involves techniques like extractive and abstractive summarization (Liu and Mirella, 2019).

Extractive summarization involves identifying important sections of the text and generating a summary by “extracting” these sections and presenting them as they are. On the other hand, abstractive summarization involves understanding the main ideas in the text and generating a summary that conveys the same information in a condensed form (Liu and Mirella, 2019), much like a human would.

6.5. Continuous Learning and Improvement

AI models are not static – they can learn and improve over time. We will implement a feedback loop where our models learn from their mistakes and improve their performance. This will involve techniques like active learning and reinforcement learning (Settles Burr, 2009).



Active learning is a special case of machine learning where a learning algorithm can interactively query the user (or some other information source) to obtain the desired outputs at new data points. In situations where unlabeled data is abundant but labeling data is expensive, active learning algorithms can greatly reduce the need for labeled data and can produce substantial improvements in learning accuracy.

Reinforcement learning, on the other hand, is an area of machine learning where an agent learns to make decisions by taking actions in an environment to maximize some notion of cumulative reward (Settles Burr, 2009). The agent learns from the consequences of its actions, rather than from being explicitly taught and it selects its actions based on its past experiences (exploitation) and also by new choices (exploration), which is essentially trial and error.

By implementing these strategies, we aim to create an AI system that can handle the complexities of legal documents in M&A transactions, making the due diligence process more efficient and accurate.

7. Overcoming Challenges and Maximizing the Benefits of NLP in M&A

The integration of Natural Language Processing (NLP) in the M&A process offers significant benefits for organizations, including streamlining operations, extracting insights from textual data, and enhancing decision-making. However, to fully leverage the potential of NLP in M&A, organizations must address various challenges and considerations. This section explores the key challenges and strategies for maximizing the benefits of NLP in the M&A context.

7.1. Data Privacy and Security

For starters, protecting data privacy and ensuring security are crucial considerations when utilizing NLP techniques in the M&A process. Organizations need to implement robust data protection measures, including encryption, access controls, and anonymization techniques, to safeguard sensitive information. Compliance with data protection regulations, such as GDPR or CCPA, is essential to maintain trust and avoid legal ramifications.

7.2. Language Nuances and Multilingual Support

Language nuances, including idioms, cultural references, and regional variations, pose challenges for NLP in M&A. Developing NLP models that can handle diverse languages and linguistic complexities is essential. Organizations should invest in comprehensive training data that encompasses various languages and dialects, as well as employ domain experts to fine-tune the models to ensure accurate and relevant results.

7.3. Training and Expertise for NLP Models

Training NLP models on domain-specific data is crucial for optimal performance in the M&A context. Organizations need to gather and annotate large-scale datasets that encompass legal contracts, financial reports, and industry-specific texts. Employing data annotation experts and collaborating with M&A professionals, legal experts, and domain specialists can help train NLP models to understand the specific nuances and terminology of the M&A domain.

7.4. Integration and Adoption Challenges

Integrating NLP solutions into existing M&A workflows and systems may pose practical challenges. Organizations must carefully plan the implementation process, considering factors such as compatibility, scalability, and user adoption. Change management initiatives, training programs, and effective communication are essential to facilitate successful adoption and ensure that stakeholders understand the benefits of NLP in the M&A process.

7.5. Continuous Improvement and Model Maintenance

In order to remain effective, NLP models require continuous improvement and maintenance. Organizations should establish processes for ongoing model evaluation, monitoring, and refinement. Incorporating feedback loops from M&A professionals and domain experts helps identify areas for improvement and ensures that the models stay up-to-date with evolving M&A trends and requirements.

7.6. Collaboration and Interdisciplinary Approaches

Collaboration between data scientists, M&A professionals, legal experts, and domain specialists is key to developing effective NLP solutions for M&A. By combining expertise from different fields, organizations can address complex challenges and develop tailored NLP models that align with the unique requirements of the M&A process.

7.7. Ethical Considerations and Bias Mitigation

NLP in M&A raises ethical considerations, including the potential for biases and fairness concerns. Organizations must actively address these issues by implementing bias detection mechanisms, ensuring transparency in model decision-making, and promoting ethical practices. Regular audits and reviews can help mitigate biases and ensure that NLP-driven M&A processes are fair and unbiased.

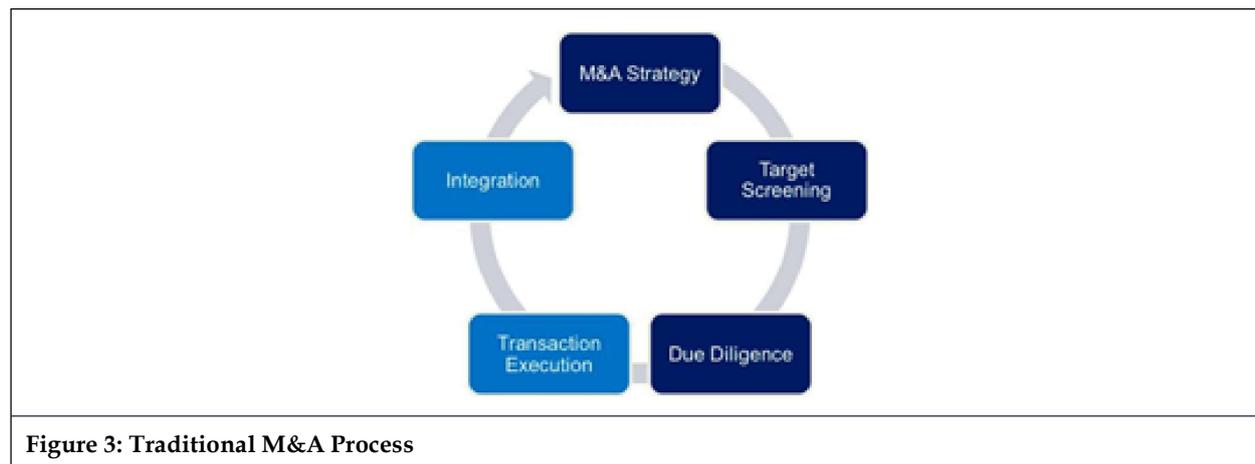


Figure 3: Traditional M&A Process

8. The Application of Natural Language Processing in Streamlining M&A Legal Processes: An Examination of AMP

Mergers and Acquisitions (M&A) transactions are notoriously complex, with due diligence emerging as a significant challenge. A report by Bureau Van Dijk (2013) revealed, "37.9% of corporate lawyers and investment bankers said that due diligence is the most tedious part of their duties." In addition, Jonathan Rowley, head M&A for the Emea regions at Swiss investment banking group UBS, echoed the challenges, stating that, "It has never felt easy or quick, and there has been lots of scrutiny on transactions at most points in the cycle" (Bureau, 2013). The heightened regulatory scrutiny and inherent complexity of due diligence processes further emphasize the need for innovative solutions. AMP's innovative solution harnesses the power of Natural Language Processing (NLP) to navigate this complexity, transforming the M&A landscape.

A key application of NLP is in the automation of reading and comprehension of legal and contractual documents. Davenport and Ronanki (2018) observed that the "Tasks include: 'reading' legal and contractual documents to extract provisions using natural language processing" (Bureau, 2013). The incorporation of Robotic Process Automation (RPA) is particularly advantageous as it is "the least expensive and easiest to implement of the cognitive technologies... and typically brings a quick and high return on investment." These findings underscore the potential of AMP to improve efficiency in M&A transactions.

In a detailed study, Bureau Van Dijk (2013) noted that "On average, due diligence in the M&A process takes 124 days to complete." The extended timeline emphasizes the magnitude of the task and highlights the considerable room for improvement. Through the innovative application of NLP, AMP aims to significantly reduce this timeline, making the process more efficient and manageable.

According to O'Leary and Nakuhuda (2023), "Conducting due diligence can be a study of frustration. Tight timelines, high stakes, and, in some cases, disaggregated deal teams compound a deal's complexity." They elaborate on the conventional approach where a lower-cost regional firm or Alternative Legal Service Provider (ALSP) is hired to review the documents, which are then handed over to the primary law firm to complete due diligence, resulting in difficulties in quality control and service delivery. However, AMP, through its advanced use of AI and NLP, could revolutionize this process.

AI and NLP have the potential to transform the due diligence process in several ways. Firstly, they can expedite deals by automating the tedious task of document analysis, a task described by O'Leary and Nakuhuda (2023) as "beyond the capacities of even the most dedicated attorney." Secondly, AI-powered diligence could "ensure better consistency in diligence and eliminate redundancies," making the process more streamlined and cost-effective.

Perhaps the most crucial contribution of AMP, as O'Leary and Nakuhuda (2023) suggest, is that the "AI-fueled diligence enables law firms to devote more time and resources to what matters most – offering value-added services to their clients" (O'Leary and Nakuhuda, 2023). By automating the "grunt work" and reducing the complexity of due diligence, AMP can allow M&A professionals to focus on the aspects they find most enjoyable: negotiating and closing deals (O'Leary and Nakuhuda, 2023).

In conclusion, the implementation of AMP and its use of NLP presents a promising opportunity to reshape the M&A landscape. The shift from tedious and time-consuming due diligence to a streamlined, efficient, and more strategic M&A process signifies a major stride in improving M&A transaction outcomes.

9. Case Studies: Successful M&A Transactions and Due Diligence Protocols Followed by AI

9.1. Case Study #1 - Streamlining Due Diligence - Benefit

The transformative potential of Artificial Intelligence (AI) in M&A due diligence is vividly demonstrated in a recent transaction involving a user of Document Intelligence, a state-of-the-art AI tool. This tool, designed to aid in the meticulous process of due diligence, provided substantial value in what is often regarded as a search for a "needle in a haystack."

In this particular transaction, the party performing due diligence deployed Document Intelligence to scrutinize vast amounts of data associated with the target company. Traditional due diligence methods would have required numerous hours of manual labor, pouring over hundreds, if not thousands, of documents to identify potential risks or opportunities.

The utilization of Document Intelligence transformed this process. The AI tool was able to swiftly analyze the extensive data pool, identifying key pieces of information that could easily have been overlooked in manual reviews. The result was remarkable. In the words of the user, they "hit a grand slam with a \$4 mn find: searching for a needle in a haystack when we didn't even know the needle was there" (O'Leary and Nakuhuda, 2023).

This significant discovery underscores the immense value AI can bring to the due diligence process. Not only did Document Intelligence streamline the review, but it also uncovered a hidden asset worth \$4 mn – a discovery that might have been missed in a traditional due diligence review.

This case exemplifies the real-world application of AI tools like Document Intelligence in M&A transactions. It highlights the potential for these tools to not only simplify and expedite the due diligence process but also to uncover significant hidden value. Such innovations hold the promise of transforming due diligence from a traditionally tedious and time-consuming process into a more efficient and valuable exercise, thus revolutionizing M&A transactions.

9.2. Case Study #2: M&A Research Institute

WioNews reports that the Japanese company M&A Research Institute, established by Shunsaku Sagami in 2018, has achieved major advancements in the business sector by utilizing Artificial Intelligence (AI) to address a crucial problem in an aging society (Swaminathan, 2023). The company's main goal is to find successors for aging small- and medium-sized business (SMEs) owners, a crucial task given that 620,000 successful companies in Japan face closure owing to a lack of successors.

The company's innovative use of AI has not only addressed a societal problem but also led to substantial financial success. Since its debut on the Tokyo Stock Exchange in June 2022, the company's stock has more than tripled its opening price, with a 47% rise in the stock this year alone. As of May 16, Shunsaku Sagami, who holds a 72% stake in the company, is worth \$950 mn according to the Bloomberg Billionaires Index (Swaminathan, 2023).

Businesses with yearly revenues of up to 500 million Japanese yen, or \$3.7 mn, are the main focus of M&A Research Institute. The business asserts that it can complete M&A deals using AI and proprietary data in 49 days to six months, which is a considerable improvement over conventional transactions, which sometimes take more than a year from request to conclusion. The business doesn't charge a fee until the transaction is finished, and then it can be up to 5%.

The success of M&A Research Institute demonstrates the transformative potential of AI in the M&A sector. By automating and accelerating the process of matching business owners with successors, the company has not only created a profitable business model but also provided a valuable service to the aging population of business owners in Japan.

The M&A Research Institute is now investigating ways to perhaps shorten the time-consuming due diligence portion of every M&A transaction. This may be accomplished by utilizing potent NLPs that can quickly fact-check and proofread thousands of legal papers, saving businesses millions of dollars and hundreds of hours for investment banks and different law firms.

9.3. Case Study #3 - Dili.ai

Dili.ai (2023), an up-and-coming firm founded by Anand Chaturvedi, Brian Fernandez, and Stephanie Song, is changing the due diligence procedure in M&A deals by utilizing the power of artificial intelligence. The business has created an AI-powered data room that accelerates the due diligence procedure and equips financial experts to operate more productively.

Traditional data rooms and the due diligence process have remained largely unchanged for the past two decades, often resulting in a user experience that is inefficient and cumbersome. *Dili.ai* is addressing this issue by introducing an AI-powered data room that significantly enhances the due diligence process. The AI-powered data room is designed to streamline the process, making it more efficient and less time-consuming.

One of the standout features of *Dili.ai* is its "Analyst-as-a-Service" offering. The AI system can answer any questions about a data room, create reports, point out inconsistencies, build charts, take notes, draft emails, transcribe calls, submit requests, and much more. This feature essentially acts as a virtual analyst, assisting finance professionals in their due diligence tasks and enabling them to focus on more strategic aspects of the M&A transaction.

As a company that utilizes artificial intelligence, *Dili.ai* understands the sensitivity of Material Nonpublic Information (MNPI) and the importance of maintaining data privacy and confidentiality. The company is committed to robust data privacy measures to ensure that all information is protected (*Dili.ai*, 2023). This commitment to privacy and security is a critical aspect of *Dili.ai*'s offering, given the sensitive nature of the information involved in M&A transactions.

9.4. Testimonial

The effectiveness of *Dili.ai*'s solution is best illustrated by a testimonial from Alonzo F., an investment banker: "As a seasoned investment banker, I was initially skeptical about incorporating AI into my due diligence process. But after using *Dili*, I am now a firm believer in the power of AI-enabled data room infrastructure for capital markets deals" (*Dili.ai*, 2023).

In conclusion for this case study, *Dili.ai* (2023), the M&A Research Institute (Swaminathan, 2023), and Document Intelligence (O'Leary and Nakuhuda, 2023) all profoundly exemplify how AI can be used to accelerate the due diligence process in M&A transactions. By leveraging AI to streamline the process and assist finance professionals, these companies and products are making a significant contribution to the evolution of M&A transactions, and we could see them being transformative disruptors that may ignite the eighth wave of mergers and acquisitions deal making history.

10. Conclusion

The application of NLP and AI in streamlining M&A processes presents a transformative opportunity for the industry. Through the case studies and discussions presented in this paper, it is evident that the adoption of

innovative AI solutions, such as AMP, can revolutionize the way due diligence is conducted, improve efficiency, and unlock hidden value in M&A transactions. The challenges associated with M&A due diligence, including the complexity of legal documents, the time-consuming nature of manual reviews, and the potential for oversight, have long been recognized by professionals in the field. However, advancements in NLP and AI technologies have paved the way for significant advancements in addressing these challenges.

AMP, with its utilization of state-of-the-art NLP models, such as BERT and GPT3, offers a powerful concept for automating the reading, comprehension, and analysis of legal and contractual documents. By leveraging domain-specific fine-tuning, AMP can understand the nuances of M&A transactions and identify key entities and information, streamlining the due diligence process and reducing the time required for completion (Davenport et al., 2023). The numerous case studies (Dili.ai, 2023; Swaminathan, 2023; O'Leary and Nakuhuda, 2023) further illustrate the real-world impact of AI in M&A transactions. From the remarkable discovery of hidden assets worth millions of dollars to the creation of successful businesses that match again owners of SMEs with successors, these examples exemplify the transformative potential of AI in the M&A landscape.

Furthermore, AMP's technical underpinnings, such as Named Entity Recognition, information extraction and summarization techniques, and continuous learning and improvement, ensure that the system evolves and adapts to the complexities of the legal domain, providing accurate and efficient analysis of legal documents. The integration of NLP and AI technologies in M&A processes through AMP represents a significant step forward for the industry. By streamlining due diligence, automating document analysis, and uncovering hidden value, these technologies enable professionals within the M&A scope (Bureau, 2013) to focus on more strategic and value-added activities (Liu et al., 2023). The benefits of enhanced efficiency, reduced costs, and improved transaction outcomes make a compelling case for the adoption of AI in M&A transactions (O'Leary and Nakuhuda, 2023).

As the field continues to evolve and AI technologies advance, it is crucial for professionals to embrace these innovations and adapt their practices to harness the full potential of NLP and AI in M&A legal processes. With the right tools and strategies in place, the future of M&A transactions holds great promise, with increased efficiency, improved outcomes, and enhanced value creation for all stakeholders involved.

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Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Abbreviations

AI	-	Artificial Intelligence
AMP	-	Accelerated Mergers and Acquisitions Processes
AWS	-	Amazon Web Services
BERT	-	Bidirectional Encoder Representations from Transformers
CEO	-	Chief Executive Officer
CNN	-	Convolutional Neural Network
DCFs	-	Discounted Cash Flows
EdTech	-	Educational Technology
FSA	-	Fullstack Academy
GDPR	-	General Data Protection Regulation
GPT	-	Chat Generative Pre-Trained Transformer
LBOs	-	Leveraged Buyouts
LLM	-	Large Language Model
M&A	-	Mergers and Acquisitions
ML	-	Machine Learning
NER	-	Named Entity Recognition
NLP	-	Natural Language Processing
PEG	-	Private Equity Groups
RPA	-	Robotics Process Automation
UCF	-	University of Central Florida
SMEs	-	Small and Medium Sized Businesses
SVP	-	Senior Vice President

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