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M.Sc. in Supply Chain Management

Postgraduate Dissertation

AI-Enabled Negotiation Strategies in Supply Chain Operations

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Patras, Greece, June 2024

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AI-Enabled Negotiation Strategies in Supply Chain Operations

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This thesis is dedicated to

My family

My grandmother

The Professors of SCM-HOU

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Abstract

Effective negotiation strategies are vital for the supply chain management and operations ecosystem, as they are applied in matters that are related to cost management issues, suppliers' agreements, communication with third parties, sourcing raw materials and many more. In order to have a smooth operation across the supply chain, it is essential to keep good relations with both suppliers and customers. The majority of these negotiations take place by experienced humans (executives, managers or someone appointed to run a negotiation process). However, the evolving and innovative field of AI and machine learning has triggered the use of AI tools for the same applications. Nowadays, a significant number of enterprises own AI suites that negotiate with suppliers. These suites are backed up with a huge amount of data that assists them to take better decisions. Additionally, these systems have access to market trends, current geopolitical issues, list of active suppliers, updated costs of raw materials, current status of warehousing and many more. This technology assists with decision making, recognizes patterns within the supply chain operations and reads details in agreements. In many cases, AI tools are autonomous to deal with third parties and make a decision by themselves. However, this promising technology still matures and lacks many things, like a framework of both ethical and legal regulations, while a wrong dataset could bias and manipulate the decision making. The scope of this work is to explore the use and trust of AI tools in decision making for negotiation strategy activities within the supply chain environment.

Keywords

Negotiation strategy, AI tools, Supply Chain Management, Data-Driven Decision Making

Περίληψη

Οι στρατηγικές διαπραγμάτευσης αποτελούν κομμάτι ζωτικής σημασίας για το οικοσύστημα της εφοδιαστικής αλυσίδας, καθώς εφαρμόζονται σε θέματα που σχετίζονται με διαχείριση κόστους, συμφωνίες με προμηθευτές, επικοινωνία με τρίτους, προμήθεια πρώτων υλών και άλλα πολλά. Για να διατηρηθεί η ομαλή λειτουργία της εφοδιαστικής αλυσίδας, είναι απαραίτητο να διατηρούνται καλές σχέσεις τόσο με προμηθευτές όσο και με πελάτες. Η πλειοψηφία αυτών των διαπραγματεύσεων πραγματοποιείται από έμπειρους ανθρώπους (στελέχη, διευθυντές ή κάποιον που έχει διοριστεί για να διεξάγει τη διαδικασία διαπραγμάτευσης). Ωστόσο, ο εξελισσόμενος και καινοτόμος τομέας της τεχνητής νοημοσύνης και μηχανικής μάθησης έχει καταφέρει να κάνει χρήση αυτών των εργαλείων για τις προαναφερθείσες εφαρμογές. Σήμερα, ένας σημαντικός αριθμός επιχειρήσεων διαθέτει λογισμικά τεχνητής νοημοσύνης που διαπραγματεύονται με προμηθευτές. Αυτά τα λογισμικά υποστηρίζονται από έναν τεράστιο όγκο δεδομένων που βοηθά το λογισμικό να παίρνει καλύτερες αποφάσεις. Επιπλέον, αυτά τα συστήματα έχουν πρόσβαση σε πληροφορίες, όπως είναι οι τάσεις της αγοράς, τρέχοντα γεωπολιτικά ζητήματα, λίστα ενεργών προμηθευτών, ενημερωμένο κόστος πρώτων υλών, παρούσα κατάσταση της αποθήκης και πολλά άλλα. Η τεχνητή νοημοσύνη βοηθά στη λήψη αποφάσεων, αναγνωρίζει μοτίβα στις λειτουργίες της εφοδιαστικής αλυσίδας και διαβάξει λεπτομέρειες στα συμβόλαια. Σε πολλές περιπτώσεις, τα εργαλεία τεχνητής νοημοσύνης έχουν ανεξαρτησία και αυτονομία για να διαχειριστούν και λάβουν αποφάσεις σε μια διαπραγμάτευση. Ωστόσο, αυτή η υποσχόμενη τεχνολογία εξακολουθεί να ωριμάζει αλλά και να στερείται πολλά πράγματα, όπως ένα πλαίσιο ηθικών και νομικών κανονισμών, ενώ ένα λανθασμένο σύνολο δεδομένων θα μπορούσε να προκαταβάλει και να χειραγωγήσει τη λήψη αποφάσεων. Ο σκοπός αυτής της εργασίας είναι να μελετήσει τη χρήση και την εμπιστοσύνη των εργαλείων τεχνητής νοημοσύνης στη λήψη αποφάσεων για εφαρμογές στρατηγικής διαπραγμάτευσης στο περιβάλλον της εφοδιαστικής αλυσίδας.

Λέξεις – Κλειδιά

Στρατηγική διαπραγμάτευση, TN, Διοίκηση Εφοδιαστικής Αλυσίδας, Λήψη αποφάσεων από δεδομένα

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List of Abbreviations & Acronyms

AI	Artificial Intelligence
B2B	Business to Business
B2C	Business to Customers
BATNA	Best Alternative to a Negotiated Agreement
EU	European Union
GAI	Generative Artificial Intelligence
GPT	Generative Pre-training Transformer
MSc	Master of Science
IoT	Internet of Things
PhD	Doctor of Philosophy
R&D	Research and Development
UI	User Interface
UX	User Experience
WATNA	Worst Alternative to a Negotiated Agreement,

1. Introduction

1.1 The importance of negotiation

Dowry is the most common negotiation example, with deep roots in many cultures and societies. It involves a discussion between two parties, the groom's and bride's family, which takes place prior to an engagement/ wedding and is related to the offer of various assets. These assets include money, jewelry, household items, livestock, land and other valuable objects.

Negotiations take place in many aspects in family and business matters, salary and contract discussions, real estate transactions, international trade and supply chain agreements, mergers and acquisitions, political resolutions and diplomatic relations. According to Scotwork, the 4 most famous negotiations in history are Brexit, Paris Climate Accord, Treaty of Versailles and Strategic Arms Limitation Talks (Scotworkteam 2023). These negotiations proved the importance of having high-skilled negotiators, with an effective communication ability and the role of cooperation. The most recent Brexit negotiation started with the UK referendum on EU membership on 23 June 2016 while still in May 2023 EU took further steps in order to implement the Windsor Framework (Timeline - The EU-UK withdrawal agreement 2024). Several research journals have examined this complex case (Christian and Peters 2024; Martill and Staiger 2021; Walter 2021), which triggered the first concerns in the EU ally and policy, after the financial crisis back in 2009.

Definitely, each negotiation is unique, with its own set of challenges. Sometimes things are on the edge, so there is a need for a delicate handling, with a lot of patience, in order to avoid any type of conflict with a potential bad outcome. Just imagine the case where any of the aforementioned famous negotiations had turned out otherwise. Billions of people would have been affected economically, politically and socially, influencing global markets, governance structures, and societal norms. By studying the successes and failures of all historical negotiations, we can accumulate valuable insights and apply them to our own interactions, striving for constructive and positive outcomes. Additionally, these examples highlight the necessity of adaptability, cultural understanding, and strategic thinking in achieving successful negotiation results. Thus, it is evident that negotiation is a complex, tough and challenging task, usually ending with a professional and/or personal cost for the

losing party. One must be thoroughly prepared before entering the negotiation arena. This entails to conducting extensive research on the case, studying similar scenarios, selecting the right team members for the negotiation party, having a B, even a C plan, and, if possible, staying one step ahead of the other party to tilt the outcome in one's favor.

Thus, we understand that the negotiation party manages a variety of factors, including information gathering (Parvaneh and Akbari 2022), data analysis (Baber and Fletcher-Chen 2020), the formation of a comprehensive negotiation strategy (Saeed 2008), culture of the opposite negotiation side (Gunia, Brett, and Gelfand 2016) and back-up plan (Florijn, Yolum, and Baarslag 2024). If we would like to digitize the aforementioned processes, then the information gathering can be seen as the input data, while the analysis represents the algorithm that processes them. The selected algorithm is guided by the negotiation strategy, which is further strengthened by having the Best Alternative to a Negotiated Agreement (BATNA). This represents a simplified version of a digital tool designed to replace human negotiators. To enhance the system's capabilities and make it more advanced, several key improvements can be implemented. These include incorporating sophisticated machine learning algorithms to better understand and predict negotiation patterns. This is achievable by utilizing real-time data analytics in order to provide up-to-date information and integrating natural language processing to facilitate seamless communication. Additionally, the system can be designed to continuously learn from past negotiations, adapting its strategies to achieve optimal outcomes. By implementing these advancements, the digital tool can become a powerful asset in negotiation processes, offering efficiency, consistency, and data-driven decision-making.

1.2 Main strategies in negotiation activities

According to Hiam, Olander and Lewicki there are five negotiation strategies (Hiam, Olander, and Lewicki 2008) depicted in the next figure. Negotiators refer to figure 1 in order to determine the most suitable approach. This figure focuses on two key dimensions: the importance of substantive outcomes (both tangible and intangible gains central to the negotiation) and the importance of the relationship. These concepts provide a valuable foundation for evaluating the overall negotiation and each specific issue within it. However,

beyond relationship and substance, various other factors may influence the selection of an appropriate negotiation strategy

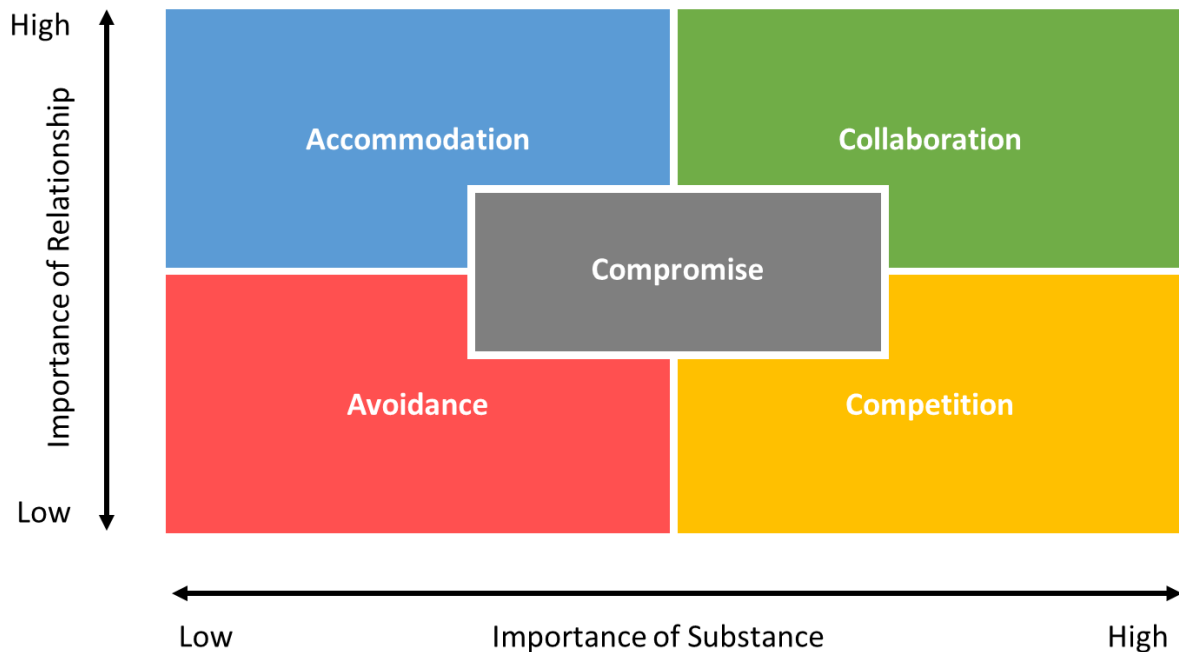


Figure 1: Choosing a negotiation strategy approach depending on the importance of substance and relationship

According to the negotiation strategy figure, we observe that a low importance substance but with a relationship between the two parties that is highly valued, leads to an accommodation type strategy. In this approach, one party prioritizes and invests in building the relationship. On the other hand, the competition strategy approach is the opposite case, where the relationship has a low valuation while the substance importance is high. Here, one side dominates at the expense of the other. The best strategy where both parties are satisfied with the outcome is the collaboration policy. This is a win-win situation and both sides value the collaboration. Finally, the compromise tactic satisfies just the basic stuff per side (Baber and Fletcher-Chen 2020).

1.3 Objectives of this work

Our goal is to examine the trend of integrating AI tools into negotiation activities within Supply Chain Management and Operations. By conducting this analysis, we aim to understand how AI is being leveraged to optimize negotiation processes, enhance decision-

making efficiency, and improve overall supply chain performance. This study will also explore the challenges and benefits associated with the adoption of AI in these critical areas, providing insights into future developments and best practices.

To ensure the successful achievement of the goal, I will define two specific objectives for this work. These objectives are designed to provide clear direction and measurable milestones.

Table 1: Objectives of this work

OBJECTIVES	
OBJ. 1	EXPLOIT NEGOTIATION STRATEGIES BY USING AI TOOLS This objective aims to investigate the use of AI tools and propose potential ways in order to improve negotiation strategies. By using the survey, we will investigate the existing trend of individuals on deploying AI tools for their professional tasks in the Supply Chain operations
OBJ. 2	TRUST AI TOOLS FOR NEGOTIATION STRATEGIES This objective aims to explore and evaluate if people trust AI tools for decision making in their professional tasks. Additionally, we will discuss the factors influencing this trust and depending on the analysis of the survey, we will propose strategies to improve it.

The basic challenge here is that AI comprises the development of algorithms, software, and hardware, in order to enable machines to perform tasks that typically require human intelligence, such as learning, reasoning, problem-solving and decision-making (Ofosu-Ampong 2024). Humans learning is a process both complex and multifaceted, involving various cognitive, emotional, and social elements (Mosqueira-Rey et al. 2023). To facilitate human learning effectively, several key components are necessary, including a supportive learning environment, suitable teaching methods, and access to adequate educational resources. According to Ten, humans learning progress is driven by their curiosity to explore (Ten et al. 2021). But what may drive the AI learning progress?

2. Literature Review

Over the past few years, there has been a significant trend towards the utilization of AI technology across various applications, in order to enhance efficiency, innovation and decision-making. We have witnessed the use of AI in various applications and aspects, like banking, marketing, healthcare, chatbots, social media, agriculture, robotics, e-commerce, face recognition and many more. Especially, for this year (2024), and at the time this thesis was written, there are 5 AI streams where people put a lot of effort. These are Generative AI, science and health care, regulation and ethics, multimodal AI and increase efficiency and productivity.

According to IBM (IBM 2024), Industry 4.0, also known as smart manufacturing, represents the digital transformation of this sector. It enables real-time decision-making, enhanced productivity, increased flexibility and agility, revolutionizing the way companies manufacture, improve and distribute their products. AI/ Machine Learning is one of the technologies that drives the Industry 4.0, along with the Internet of Things (IoT), Cloud and Edge computing, Digital Twin and Cybersecurity. The so called nowadays “smart enterprises” or “smart factories” implement a series of the aforementioned digital tools in order to analyze data for decision making, integrate tools, systems and machines on the same architecture, thus operating part of the operations and creating a more effective strategy for their supply chain activities.

Supply Chain encompasses a wide range of management and operations (Jodlbauer et al. 2023). Consequently, it is understood that negotiation is a critical skill, that plays a vital role for these operations as it is required when dealing with suppliers, retailers, customers and mergers. In procurement, negotiation is essential for securing favorable contracts and prices with suppliers, fostering long-term relationships that benefit both parties (Philippart 2016). Effective vendor management also relies on negotiation to manage performance expectations, resolve disputes and ensure compliance with agreements and regulations. In logistics and transportation, negotiating rates and terms with service providers are important for cost-effective and reliable transportation solutions (Luncean, Mocanu, and Becheru 2017). Similarly in inventory management, negotiation helps balance costs with service levels by setting favorable terms for inventory levels, lead times and delivery schedules (Chhabria and Sia 2022; Mukwakungu et al. 2019). Distribution

strategies also benefit from negotiation, as it helps securing optimal warehousing contracts and distribution center services. In the retail and sales sectors, negotiating terms with retailers and distributors is vital for product placement and promotions, ensuring favorable sales agreements (Boyer and Jap 2022). Supplier development often involves collaborative negotiations to enhance suppliers' processes and capabilities, thereby improving supply chain resilience and efficiency. Furthermore, risk management in supply chains requires negotiating risk-sharing agreements and contingency plans with suppliers and logistics providers to handle disruptions effectively (Gurtu and Johny 2021). On the other hand, cost reduction initiatives also depend on negotiation skills to identify and implement cost-saving opportunities without compromising quality or service (Prado and Martinelli 2018). Lastly, adopting new technologies and innovations within the supply chain, involves negotiating terms with technology providers to ensure smooth implementation and mutual benefits (Dasaklis 2022; Kalkha et al. 2023; Sajwaj 2022). Effective negotiation across these areas helps achieve better terms, reduce costs, improve efficiency and build stronger relationships with customers, suppliers and partners (Vij, Mukhopadhyay, and Agrawal 2019).

Recently, Oneflow, a company that develops AI suites, conducted a survey where 34.6% of the business professionals stated that they are using these tools in contract management, while 57.3% are positive in the idea of using them (Oneflow 2024).

2.1 State of the art in AI-Enabled negotiation

Supply Chain operations are facing a radical change due to the introduction of technological advances within the Information and Communication Technologies, such as IoT, Machine Learning, AI, Blockchain, Cloud computing and 6G (Toorajipour et al. 2021). These new technologies are responsible for the automation and optimization of all activities that take place within the supply chain. It provides a better control and oversee of the operations, while an enterprise can react quickly and efficiently to any matter. Especially, AI is the most used technology in smart operations of the supply chain (Kalkha et al. 2023).

Negotiations have been the alpha and the omega in this field (Baber and Fletcher-Chen 2020). In most B2B or B2C relations there is always a negotiation interaction at some point. The negotiation involves at least two parties over one or more matters, where each party has some requirements or preferences regarding this. This process has as an ultimate

goal to reach towards an agreement point, ideally beneficiary to all parties (Martill and Staiger 2021; Oppong 2020). Negotiations can be challenging and not all times lead to the best outcome for the parties. Thus, nowadays negotiators need to be prepared prior to entering a meeting room. This means that they need to know every detail related to the issues that are to be discussed. The negotiator should be able to decide the strategy that the team will follow in order to succeed towards the set of requirements or preferences (Baber and Fletcher-Chen 2020). This includes the fact that a negotiator should be a highly skilled personnel, not only in matters of knowledge and experience, but also in cultural attitudes (Baber and Fletcher-Chen 2020; Browaeys and Price 2011; Janík 2017).

From a physics perspective, a negotiation follows the chaos theory (Oestreicher 2007). Even a small change in one of the parameters could lead to a totally different outcome. The parameters are not only related to the arguments and inputs that a negotiator uses through a discussion. During preparation someone might miss a minor but important point. Additionally, there are days where negotiators might bring the top of their game but there are also days we call... it is one of these days (idiomatic expression meaning a day in which many unpleasant things happen). Adding the crucial importance of a negotiation, this could actually cost a lot of money to the business (Brooks and Anderson 1995; Parvaneh and Akbari 2022).

AI has and is making remarkable progress in the negotiation field. As a result, more and more companies are moving towards AI to assist them in negotiation processes. This is because AI is indeed a powerful tool, making easy to mathematize a situation (Fotakis and Insua 2021; Vij, Mukhopadhyay, and Agrawal 2019). This is achievable with the introduction of the so called agents. AI agent is a virtual system (software) that can act autonomously. It receives information from its environment, makes decisions and acts based on that data (Durante et al. 2024). With the use of machine learning they can update their decisional behavior over time and try out new solutions to a problem until they achieve the goals set by humans or other agents.

In order to apply an AI tool for negotiation strategies in supply chain operations, it is essential to develop intelligent agents capable of gathering and analyzing large amounts of data (Hazon et al. 2024; Kravari and Bassiliades 2015). These agents can autonomously monitor market trends, supplier performance and inventory levels, thus providing real-time insights. Furthermore, they can simulate various negotiation scenarios, predict outcomes

based on historical data and suggest optimal strategies. By integrating these AI agents, supply chain specialists can make more informed decisions, reduce time negotiation, accomplish better prices and overall achieve better negotiation results.

For example, Bakhtin *et al.* introduced back in 2022 "Cicero" in the gameboard of Diplomacy (online version), which was the first AI agent to achieve a human-level performance. They managed to develop this agent with both cooperation and competition strategies (Bakhtin et al. 2022). For the same game, Kramár *et al.* have studied how artificial agents may use inbetween communication in order to coordinate and cooperate with other players within the game. They used various negotiation algorithms to allow agents for agreeing on contracts regarding joint plans. They managed to demonstrate that these agents were outperforming other agents that did not have this option. It is believed that this approach is way better and honest than letting humans do the negotiation, as they always try to mislead the other party about their actual intentions, forming a barrier to cooperation (Kramár et al. 2022). On the other hand, Qie *et al.* have tried to humanize a business negotiation by introducing social factors in the agent systems; emotion and familiarity (Qie et al. 2022). This could actually make the AI tools trustful by humans, as the results demonstrated that negotiations were more successful and the results fairer, without losing the competitive negotiation efficiency.

One of the major concerns in AI advances is how many people trust this technology. According to Mell *et al.* the complexity of the social process of negotiations makes difficult to well define a framework in order for the AI and its agents to navigate through this space. AI agents must understand each situation by realizing its policies and strategies (Mell et al. 2020). Ma *et al.* have pre-published an interesting work entitled "Who Should I Trust: AI or Myself?". Their basic claim is that in order for a system to assist in decision making, the correctness likelihood (CL) of the AI tool should be based on both AI's and humans' decisions, in order to build the system's trustiness towards humans (Ma et al. 2023). Controversy, Gao *et al.* claim that the efficiency of negotiations by the use of an AI tool is proved to do better due to the reduced error made by humans and the non-influence by human feelings (Z. Gao and Qian 2022). However, is it easy to make the AI tool human? Gao claims that in order to humanize a computer, it requires three components: a computing system, data and data management, and powerful artificial intelligence algorithms. But is the actual scope to humanize a system in order to be trusted?

Lately, we see a new term called generative AI. This refers to a branch of Machine Learning that can create new content, including text, images, music or video, by learning patterns from existing data (Brynjolfsson, Li, and Raymond 2023). This technology has been used by the MIT Center for Transportation & Logistics (MIT CTL), aiming to overcome complexities and demonstrate how certain applications of generative AI can be successfully implemented in the procurement function. Researchers are developing a chatbot for a leading pharmaceutical company. This bot will assist in making more efficient negotiations between managers and suppliers, by providing important information on key questions like how prices are trending for specific materials (Dugundji et al. 2024).

AI-enabled negotiation activities in the supply chain management have not yet reached a mature technology level. There are indeed many things that need to be addressed. On one side there are crucial questions, like how people are using it, do they trust this technology, what is the correct level of interaction between a negotiation and the AI tool. On the other side, it is evolving day by day by technological advances in the field, assisting professionals or an enterprise in decision making, optimizing procurement processes and enhancing overall the efficiency by minimizing risks. These advancements are enabling better data analysis, real-time insights, and predictive analytics, which are crucial for effective negotiation and risk management.

2.2 Commercial AI tools for negotiation

Several AI tools have been developed in order to assist and enhance negotiation strategies in the supply chain operations. These tools utilize cutting-edge technologies, such as machine learning and big data analytics, to automate and enhance various factors of the negotiation process.

Pactum (<https://pactum.com/>) has designed a negotiation suite that creates value to a company. According to the enterprise, one of the corporate issues is that they lose millions in untapped value due to the lack of attention and time, as they have not been able to manage their suppliers effectively or efficiently. Pactum's suite can autonomously conduct negotiations, allowing procurement teams to focus on more strategic initiatives. By automating repetitive tasks and providing real-time insights, the platform helps organizations achieve better deals, improve supplier relationships and realize significant

cost savings (Z. Gao and Qian 2022). Walmart purchased a software license back in 2019. By using Pactum's technology, Walmart was able to close deals with 68% of its suppliers in the U.S., Chile and South Africa, generating an average savings of 3% (Hoek et al. 2022). Additionally, the suppliers have the ability to create deals that are tailored to their specific business needs and objectives.

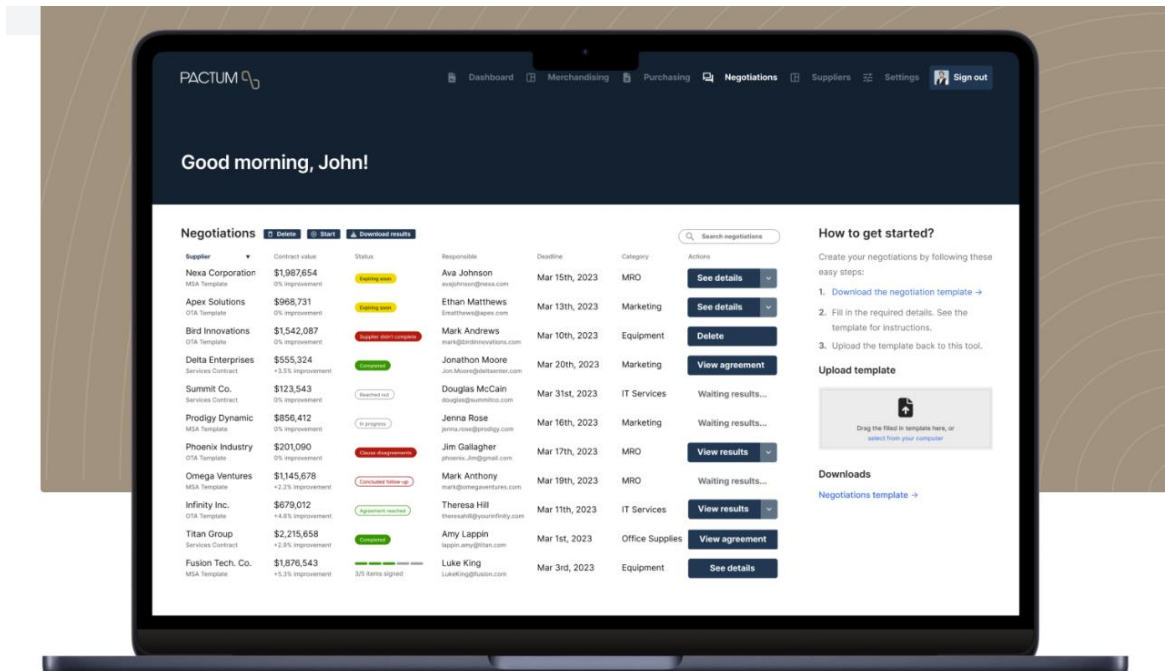


Figure 2: Pactum's suite interface (image taken from <https://pactum.com/product/>)

Oneflow (<https://oneflow.com/ai/>) has developed a software package that writes, reviews and analyzes contracts. Oneflow creates collaborative agreements, automate workflows, significantly saves time on new contracts and reduces errors by negotiating terms in the contract itself. It provides recommendations to ensure compliance and secure more favorable terms in both sent and received contracts. Additionally, the system reviews contracts in bulk, delivering instant due diligence and compliance reports across the entire enterprise portfolio. This enables users to obtain risk analysis reports, utilize a smart dashboard for an overview of contract analysis and examine usage patterns. Oneflow AI uncovers valuable insights and boosts efficiently the contract work.

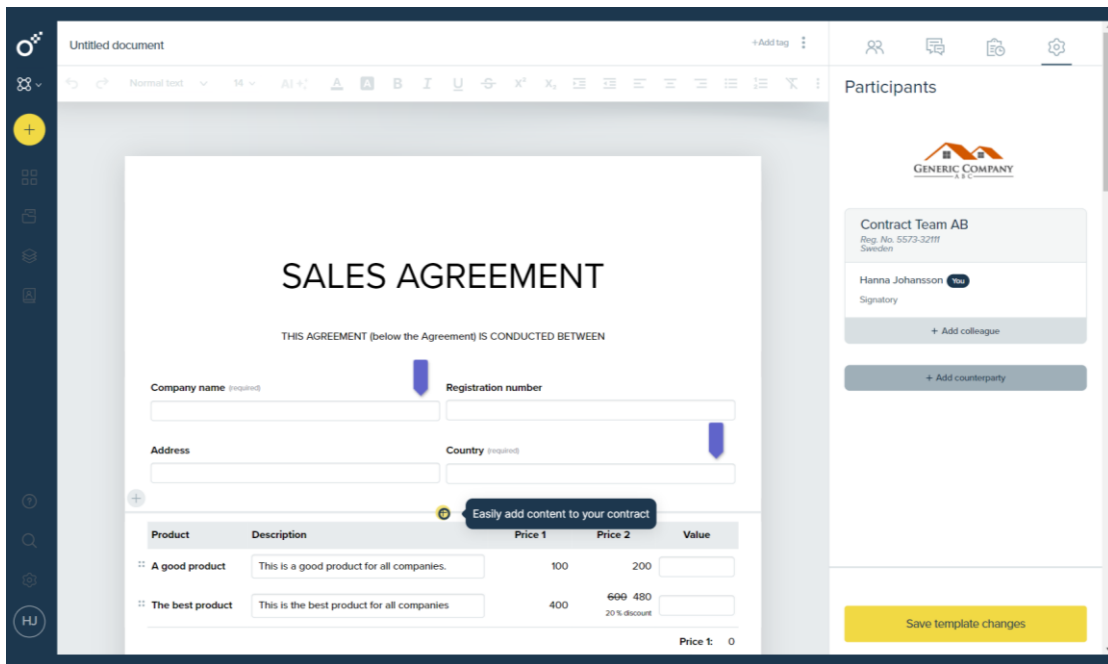


Figure 3: Onflow's suite interface (image taken from <https://oneflow.com/product-tour/>)

Ironclad (<https://openai.com/index/ironclad/>) is a contract management platform, based on GPT-4, that is used to simplify the contract review process. The platform uses data from the contracts in order to analyze terms and suggest negotiation strategies.

Within the Supply Chain Management and Operations someone will find a variety of AI tools (Thomas 2024), like the Keelvar suite (<https://www.keelvar.com/>), Supplyshift (<https://www.supplyshift.net/>), Zebra Technologies (<https://www.zebra.com/gb/en.html>) and many more (Raj 2024). However, these software do not support for the moment negotiation strategy activities.

2.3 Do people trust an AI tool for generating decisions?

AI applications range from medical decisions based on X-rays to the development of new materials with exotic properties in science. Let's not forget that as we spend time scrolling on our cell phone, we see a personalized commercial, depending on our searches. Somehow, the next day we will go to the grocery or an outlet and probably purchase the same product. Moreover, even if we are not a "scroll-fan" and avoid on using online social networking and market search, most of us have a smart watch that monitors vitals, like blood pressure, O₂, glucose, indicating a healthy or not condition. Thus, AI is applied in everyday

life. However, there is a big “BUT” ... Despite that AI is indeed part of our daily life, do people actually trust an AI tool for decision making?

If we try to find a proper answer, I will have to argue for the rest of this thesis, as this produces more and more queries. Prior to generate a discussion about the “if they trust”, I will try to reverse engineering and move at first on a simple question. For example, would you trust an AI to take a life-type decision for your professional career? Like, accepting a new job offer or leaving from your current employment to pursue your ambition. An AI platform is a data driven software that generates an outcome according to imported information, the architecture of the algorithm and how the system learns itself, in order to provide the best outcome. This example could be easily depicted in a flowchart. Let us assume that the reasons for someone to move to another work are a) Salary expectations, b) Working environment, c) Professional development and d) No reason. In order to move across the flowchart, we will need to establish a set of proper questions related to our challenge. Then, depending on our objectives, each question will have options; It is not the same accepting the first offer or accepting the best offer. Let us assume that we have two objectives here: Either an increase on the monthly paycheck or opportunity for professional development. The flowchart demonstrates an architecture where by setting the two previous objectives as the requirements (input data), it guides us towards a data-driven outcome. We notice that despite the first fact that "I want to leave my job", there is a path that leads to keep my current job. In this example, if the reason for searching a new vacancy is the monthly salary, then your current employer may come back to you with a counter offer, that will be equal or better. Also, here the architecture is based on a top-down negotiation strategy, where we start from the fact "if I want or not to leave my current job". This simplified chart can also be considered as a digitized diagram, as the possibly answers that determine the followed path are two; either YES or NO (1 or 0 in digital science). We understand from this example that in order to get the best result, we need to include any details, as a version of chaos theory is applied.

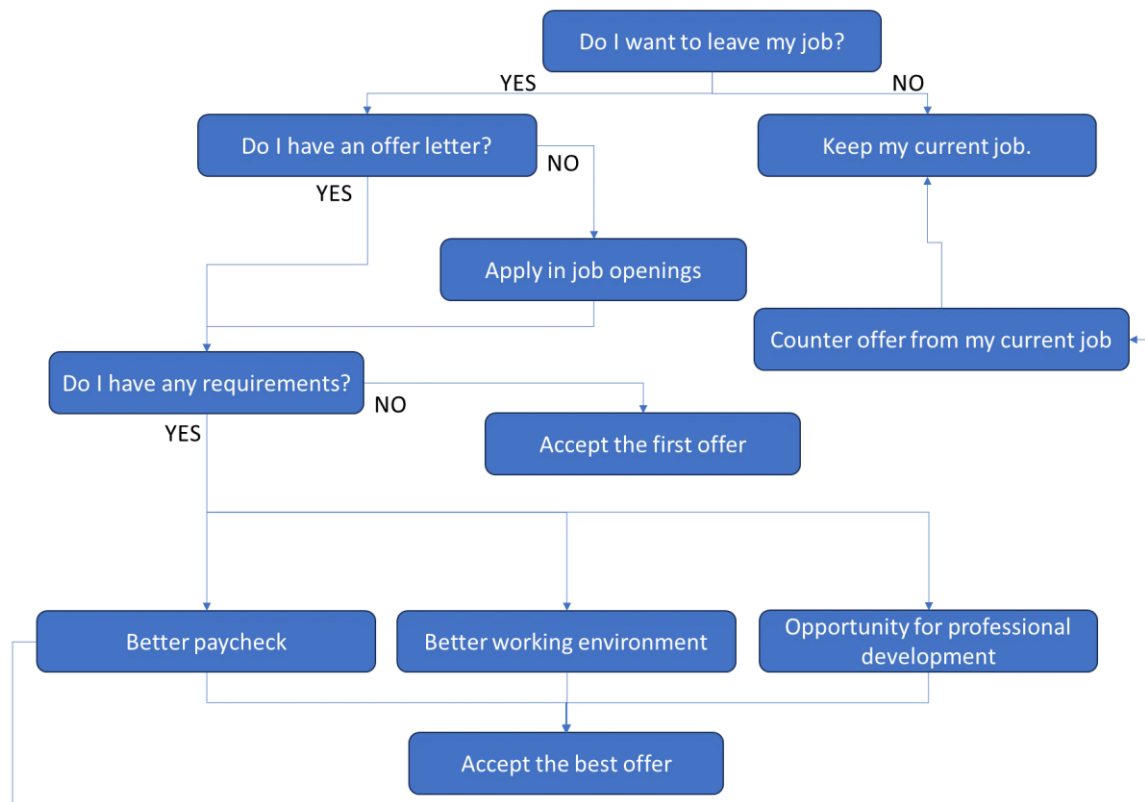


Figure 4: Flowchart demonstrating the steps related to the question "Do I want to leave my job?".

Additionally, another architecture of this scenario related to the decision-making algorithm, could result to either an identical or different result. In this scenario our start point is the question "If I am underpaid?", which leads to the next step if I want actually to change vacancy. Thus, here we follow a bottom-up negotiation strategy, as the major concern is my monthly paycheck.

The aforementioned architectures were proposed by a human (in this case myself). Although, both of them cover the basic steps of a data-driven decision, they are objective as they were designed based on my knowledge and experience. In the case, I could have access to a significant population, probably the design could have been different, less or more complex, but definitely better (due to statistical reasons). An AI tool, having access to big data, could learn through the given information and provide definitely a better strategy on the steps someone would like to follow in order to achieve her/ his/ its goals. Thus, the actual question is if you would trust the tool in creating the necessary steps that will provide to you the answer on what to do. The use of AI presents risks and challenges, raising concerns about the trustworthiness on these systems. These concerns have been intensified by

instances where AI applications were found to be biased (Belenguer 2022; Ferrara 2024; Kartal 2022; P. S. 2023; Roselli, Matthews, and Talagala 2019), discriminatory (Belenguer 2022; Ferrara 2024; Ferrer et al. 2021), manipulative (Cohen 2023; Klenk 2024; Tarsney 2024), unlawful (Bokovnya et al. 2020) or in violation of human rights (Rodrigues 2020; Sartor 2020).

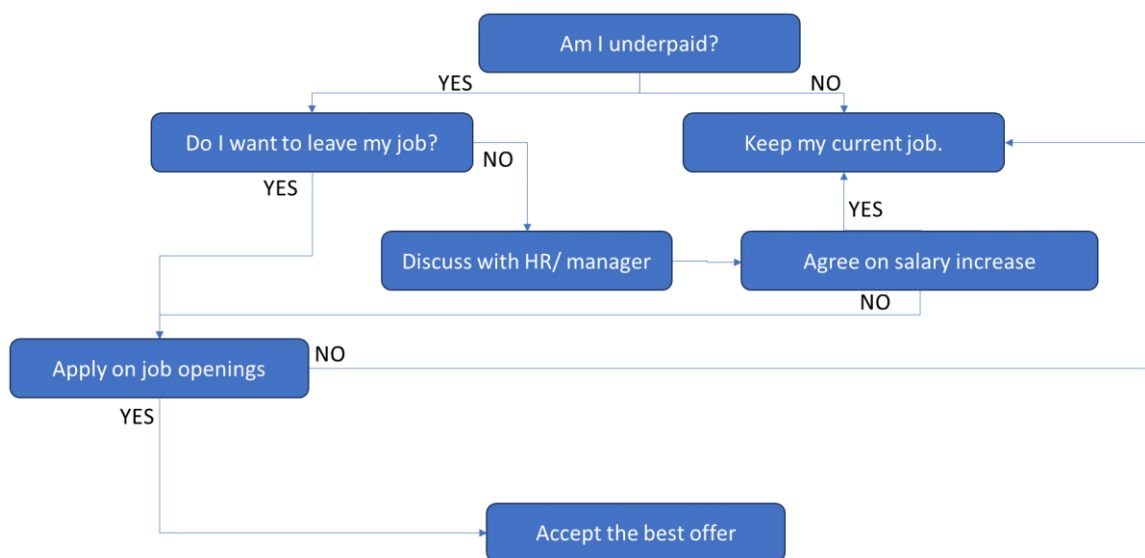


Figure 5: A different architecture of the question "Do I want to leave my job?". Here, we follow a bottom-up strategy, focusing on the paycheck.

Gillespie et. al conducted a survey where more than 17,000 individuals took part in order to understand their trust and attitudes towards AI in workplace (Gillespie et al. 2023). The survey took place in 17 countries (Australia, Brazil, Canada, China, Estonia, Finland, France, Germany, India, Israel, Japan, the Netherlands, Singapore, South Africa, South Korea, the United Kingdom, and the United States). These countries were chosen as global leaders in the AI technology. An important note of this work is that all data were collected just prior to the release of ChatGPT. In this survey 50% of the people report using AI for their professional tasks. Most of the participants find the use of AI in decision making acceptable and would prefer involvement over decisions made solely by humans.

According to another survey (Sparkes 2022), it is easier for people to accept AI-generated decisions, in the case where the process is monitored or finally checked by humans. Let us not forget that automated decision-making is already employed in various

areas, as it was mentioned earlier. An interesting example is that for the last couple of years HR departments use AI tools for shortlisting resumes of a job opening. This application has both lovers and haters. For the former, which is usually the HR, they have an easier way of taking care of a huge pile of resumes. For the latter, there is a chance not to be invited for a job interview, if your resume does not complete the AI's tool prerequisites. By this, we understand how a mistrust to these tools might start. In an interesting article in *Scientific American* (Bailey 2023), it was stated that trust is a process which depends on each person's ability to foresee others' behavior. Once someone does not "perform" according to what the neural network in our brain has established, then our trust towards that person is lost. Since, we do not know how the AI works or cannot observe the AI's "behavior", it is easier to involve people that examine the decisions made by AI systems.

Indeed, there is a need for furthermore research in this area. This should not cover only aspects like the architecture of an AI system or how does the machine learn itself. It should also be about the social aspects of the AI application in both personal and professional life. People should get educated on how AI systems can make their daily tasks easier, as well as they should be updated about all these concerns that follow a new technology. By knowing the benefits and the risks of these tools, I firmly believe that this could be the starting point for people starting trusting AI.

2.4 Beyond State of the art

AI tools, software or suites is a new trend that makes essential steps preparing the ground for a new era, where people will increasingly rely on their suggestions more and more. At a first glance, it seems that these tools have multiple advantages, like time and cost savings, attention to detail, multitasking. When compared to humans, they have a higher efficiency to performing a task and around the clock (without getting sleep). Since, the majority of negotiations are driven by facts, data and preferred or required outcomes, it becomes clear that these "cold-blooded machines" do not mix their thoughts, feelings, conscience or morality, and get the job done, executing the same every moment, without having "one of these days". Thus, if we take out the philosophical aspect of the aforementioned from the equation, we understand that the system is based on an architecture on how to interpret the input parameters in order to produce the desired results. So, is it pure

math? More or less yes, but you have to train the system in order to "understand" how it should build its case in order to reach its goals. As the system is trained on large data sets, it will generate better results.

Let's consider the AI tool as a black box that is beyond the state of the art and can actually take part in negotiations in order to either assist the company's negotiator or negotiate itself. Let's take into account the negotiation between a manufacturing company and one its suppliers.

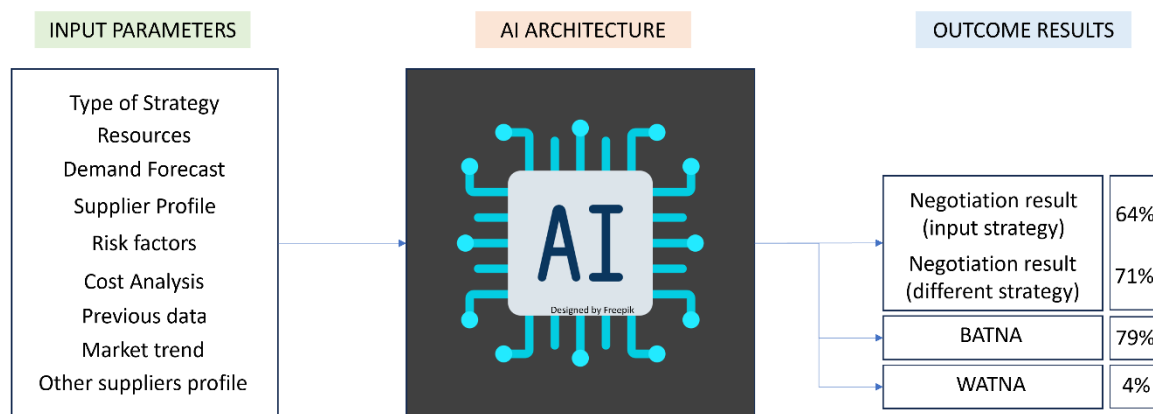


Figure 6: A layout of an ideal AI tool for generating results in negotiation activities. A success rate follows the outcome results

The platform should have a number of inputs that are related to the negotiation process case. The type of strategy could be selected either by the user or the program itself. Thus, by weighting the importance of the relationship and substance it should pick between accommodation, avoidance, collaboration, competition and compromise. The profile of this supplier should contain data related to the financial status, consistency and operational capacity. In the case that this supplier is active with the company, then the data should enclose the performance score in terms of delivery times, quality of goods and compliance with regulations, as well as older agreements. The same data could be added for competitors, as this will define the BATNA. The AI tool should be familiar with the current market trend like costs, followed by forecast that may impact supply and demand. A detailed analysis should provide all the individual costs, included raw materials, logistics and other indirect. As it is known, supply chain operations can easily be disrupted by various factors. These include natural disasters, pandemics, geopolitical issues and specific regulations per state. By taking into account all these pieces of information, the system should be able to provide

with a success rate of the chosen strategy. It could also, propose the second-best strategy if it has a higher success rate than the one we selected, as well as the BATNA and WATNA. Of course, the outcome results can be, more or less, specified for each case (distributive or integrative). Here, we demonstrated a theoretical scenario where the system makes a prognosis based on the provided data. Thus, it is understood the importance of having big and accurate sets of information in order for the platform to generate valid prognostic results.

A similar upscaled scenario is to use the AI platform as an assistant or negotiator in real time. In this case, the architecture of the tool should be based on a point-system, depending on the interests of each party. Fleming has developed a similar tool named “Negotiation Scorecard” that helps B2B to handle better negotiation activities by developing an interaction style consistent with that situation (Fleming and Hawes 2017). It is well known that Raiffa (Raiffa 2007) succeeded to demonstrate a practical approach for managing priorities and potential outcomes in negotiations by using a table. This table organizes the interests and outcomes of the negotiation by using a point system that sums up to 100. In order to evaluate the importance of each of the presented issues and take advantage of the benefits of various outcomes, the system should be able to assign a different point system to Raiffa’s scorecard, depending on the implemented strategy. Since the maximum sum of the issue values is 100, the algorithm should try to reach the maximum score per issue through its decisive weighting of each factor's importance.

Let’s take a hypothetical case, between us (a manufacturer) and a random supplier. When dealing with a supplier the most important things are low cost, fast delivery time, quality of delivered products, flexibility of the demand capacity, good payment terms and duration of agreement. We will set-up a Raiffa’s scorecard by choosing two scenarios, a competitive and a collaborative.

Table 2: Raiffa Scorecard for a hypothetical case for a collaborative scenario

Issue	Issue Value	Outcome	Outcome Value
Cost	25	Low	25
		Medium	18
		High	12

Delivery time	15	Fast	15
		Medium	10
		Slow	5
Quality of products	20	Best	20
		Medium	14
		Low	9
Demand Capacity	10	Flexible	10
		Limited	8
		Inflexible	6
Payment terms	12	Good	12
		Medium	8
		Poor	4
Duration of Agreement	18	Long	18
		Medium	14
		Short	9
	100		

This is a simplified example showing some of the vital issues that are set on the table during a negotiation process between two parties that are involved in the Supply Chain field. Based on the strategy, the system prioritizes differently the issues and the outcome value, in order to successfully deliver the optimum option. Again, letting the system to learn through imported data on various similar cases will assist in producing better results. Going one step further, the tool could also advise the user to change tactics due to certain arguments, that have as a goal the best outcome for its company.

Depending on the scenario, collaborative or competitive, the issue values are different. This way, the system prioritizes according to the input valuable issues each user

sets. Trying to mathematize the importance of substance and relationship, we could assign points (-1 for low, 0 for medium and 1 for high).

Table 3: Raiffa Scorecard for a hypothetical case for a competitive scenario

Issue	Issue Value	Outcome	Outcome Value
Cost	30	Low	30
		Medium	20
		High	10
Delivery time	30	Fast	30
		Medium	18
		Slow	10
Quality of products	20	Best	20
		Medium	14
		Low	9
Demand Capacity	5	Flexible	5
		Limited	3
		Inflexible	1
Payment terms	5	Good	10
		Medium	7
		Poor	4
Duration of Agreement	10	Long	10
		Medium	8
		Short	6
	100		

Table 4: Mathematizing the importance of substance and relationship in order to define the negotiation strategy

IMPORTANCE SCORE IN NEGOTIATION STRATEGIES			IMPORTANCE OF SUBSTANCE		
			LOW	MEDIUM	HIGH
			0	1	2
IMPORTANCE OF RELATIONSHIP	HIGH	2	Accommodation		Collaboration
	MEDIUM	1		Compromise	
	LOW	0	Avoidance		Competition

Adding up the points per column and row, we get a set of sums, ranging from zero to four. Four indicates the best outcome of a negotiation, while zero addresses the worst scenario. We observe on Table 5, that depending on the chosen strategy the system could have a new weight factor that affects also the Raiffa scorecard. For example, if instead of the strategy we choose points, then we see that we will get the same outcome by following three different strategies.

Raiffa and importance scorecard are an easy way to depict the fact that by using mathematics and implementing a point system strategy based on what are the important issues in a negotiation, parties can systematically evaluate and compare different outcomes to make more informed and balanced decisions. People understand better math than AI. Consequently, the aforementioned question "Do people trust an AI tool for generating decisions?" converts to "Do people trust math for generation decisions?". However, is it enough? What else is missing from AI-tools in order to be trusted and used in negotiation strategies in Supply Chain Operations?

Mathematizing AI in a basic context is a crucial step in order for the user to understand and leverage its capabilities effectively in decision-making processes (Vij, Mukhopadhyay, and Agrawal 2019). The user should have a basic knowledge on how to do this transformation in order for the context to be used as input parameters of the issue. This way, the AI tool is not, as we mentioned above, just a black box. Moreover, it is important

the system to have a user-friendly environment. The role of UX/UI designers is to make this interface intuitive and accessible to users, efficient to navigate and operate. Various studies have demonstrated that the first impression of an interface (such as an app or webpage) significantly influences the user's perception and experience, determining whether their reaction will be positive or negative (Brdnik, Heričko, and Šumak 2022).

Table 5: Point system of the importance of substance and relationship for the definition of the negotiation strategy

IMPORTANCE SCORE IN NEGOTIATION STRATEGIES			IMPORTANCE OF SUBSTANCE		
			LOW	MEDIUM	HIGH
			0	1	2
IMPORTANCE OF RELATIONSHIP	HIGH	2	2	3	4
	MEDIUM	1	1	2	3
	LOW	0	0	1	2

Definitely, when comparing AI to humans, the former excels in performing big data analysis processes or discovering a trend within a vast amount of information. However, for the moment the role of human judgment remains essential for fine points and context-sensitive decisions. By synergizing AI's computational power with human's expertise, we can achieve more effective negotiation strategies. Furthermore, to prevent biased, unlawful or manipulative outcomes, human oversight should aim to incorporate ethical considerations, law regulations and diverse perspectives into the AI decision-making process. This ensures that the AI operates within ethical boundaries and aligns with human values and laws.

In order to manage working beyond the State-of-the-Art, we must establish a robust research methodology aligned with the two primary objectives outlined in Chapter 1. This involves to investigating how the identified gaps impact both AI developers and users in the

present context. Our methodology will focus on addressing these deficiencies to the public and understand how we should improve the practical application of AI tools in negotiation strategies within the Supply Chain Management and Operations.

3. Research Methodology

Our aim is to investigate the trend of integrating AI tools into negotiation activities within the Supply Chain Management and Operations. Through this analysis, we intent to understand if and how AI is being utilized to assist negotiation processes, enhance decision-making efficiency and optimize overall supply chain performance. Additionally, this study will explore the challenges and benefits associated with adopting AI in these critical areas, providing insights into future developments and best practices.

The first objective is to explore and propose methods to enhance negotiation strategies through the use of AI platforms. We will investigate the types of AI tools employed by professionals in the supply chain operations through a survey. The second objective is to explore and evaluate the level of trust professionals have in AI tools for decision-making in their daily tasks. We will further discuss the factors influencing this trust and propose strategies based on the survey analysis in order to improve it.

3.1 Method selection

There are various methods to examine and explain a study and its findings, including using numerical measures, descriptive analysis or a combination of both. (Taherdoost 2022).

Qualitative and quantitative methods are fundamental approaches in research, each serving distinct purposes and providing unique insights (Groves et al. 2009). Qualitative methods focus on understanding the scientific reasons, opinions and motivations behind a phenomenon. They are typically used to gain deep, contextual insights through techniques such as interviews, focus groups and case studies. This approach is valuable for exploring complex issues where numerical data alone may not capture the full picture. On the other hand, quantitative methods involve the collection and analysis of numerical data to identify patterns, relationships and trends (Vasileiadou 2023). These two methods, which include surveys, experiments, and statistical analysis, are crucial for testing hypotheses and making conclusions about large populations (Taherdoost 2022). By combining both qualitative and quantitative approaches (hybrid method), researchers can leverage the strengths of each one to provide a more comprehensive understanding of the study topic. This is due to the fact

that each method complements the other by offering both comprehensive and detailed insights (Barroga and Matanguihan 2022).

Indeed, as it was stated by Vasileiadou (Vasileiadou 2023), the approach selection of the research methodology between qualitative, quantitative or hybrid approach, depends entirely on the nature of the research questions. However, I would like to comment here that this is not exclusively determined by this as there are other factors that can influence the choice. These are the objectives of the study, the type of data needed and the available resources. While the nature of the research questions is certainly an important consideration, these additional factors play also a crucial role in determining the most suitable approach (Groves et al. 2009).

According to the aforementioned claims and in order to successfully address the specified objectives of this work, I will perform a quantitative approach based on questions and target towards individuals that are related with supply chain applications, whether using AI platforms or not. This involves identifying and analyzing relevant quantities to formulate a hypothesis and apply it to the findings.

3.2 Data Collection

In order to create a framework that explains the study and offers a set of arguments, I will apply a quantitative method and collect sets of data. The collection of data, or more accurately the production of data (Groves et al. 2009), will take place by using a web-type survey. Here, the target group will have to follow a hyperlink that leads the individuals to the survey's webpage. This approach appears suitable for the data collection given the fact that it can disseminate to a large population and is faster than interviewing people. Additionally, people can take the survey any time/ day, while the data are automatically sorted per question into a database.

The survey was conducted based on current trends that support supply chain activities. Literature review and commercially available tools that are both involved in AI-enabled negotiations were examined thoroughly in order to structure the survey, which is presented in Appendix A. It was disseminating in Europe and USA, targeting people that are using AI tools for negotiation purposes. This target-group should consist of professionals working within various departments that are involved with supply chain activities, like

Customer Service, Logistics, Manufacturing, Procurement, Production, Research and Development, Sales, Warehousing. It was stated prior to taking the survey that no data of the participants are collected (anonymous survey) and consists of multiple-choice and open-ended questions. Also, the total time was mentioned to be around 12 minutes for the survey's completion. It was stated that the responses will be completely treated as confidential and used solely for academic research purposes. The survey was divided into 7 parts:

1. **Demographic Information:** This section was used to collect demographic data of the participants. This included gender indication, age group, education level, department they work, job level of the company and years of experience the individuals have within supply chain activities.
2. **Current Practices:** The second section included the rating of questions/ arguments related to the current practices employees have at their work environment. These questions were focused on the use or not of any AI tool for professional tasks and how people feel about them by rating the following statements.
 - 2.1. *Do you trust AI tools?*
 - 2.2. *Are you using an AI tool for your professional tasks?*
 - 2.3. *Are you using an AI tool outside of your work?*
 - 2.4. *Does your company use AI tools for its daily operations?*
 - 2.5. *Does your company own an AI tool license?*
 - 2.6. *Is your company discussing to purchase an AI software license tool?*
 - 2.7. *Do you believe that you benefit from the use of an AI tool?*
 - 2.8. *Are you comfortable with the use of an AI tool?*
 - 2.9. *Are you confident with the provided outcome from an AI tool?*
 - 2.10. *Do you agree with the use of AI tools at your work?*
 - 2.11. *Are you familiar with the risks of an AI tool?*
 - 2.12. *Are you using an AI tool to assist you on decision making?*
 - 2.13. *Are you allowing an AI tool to make a decision for you?*
 - 2.14. *Are you allowing an AI tool to make a decision for you as long as there is a check-point by a human?*
 - 2.15. *Would you like to learn more about AI tools?*

Additionally, the target group was asked which AI tools, platforms or suites is used by them.

3. **Applying an AI tool during negotiations:** In this section we presented to the participants a hypothetical scenario where their company decides to purchase an AI platform in order to negotiate with suppliers and customers and were asked to rate a set of questions/ arguments.
- 3.1. *Would you trust the AI tool to deal with low-risk negotiations?*
 - 3.2. *Would you trust the AI tool to deal with high-risk negotiations?*
 - 3.3. *Would you bypass the AI tool and negotiate directly with the other parties when you do not agree with the tool's outcome?*
 - 3.4. *Independently of the risk, would you use the AI tool in the case where your manager puts a pressure to complete a negotiation?*
 - 3.5. *Independently of the risk, would you use the AI tool in the case where there is no time to go through the terms of a negotiation by yourself?*
 - 3.6. *Will you enable the AI tool during a negotiation that does not go well?*
 - 3.7. *Will you disable the AI tool during a negotiation that seems to move towards a different strategy (but doesn't mean that it will go)?*
 - 3.8. *Will you disable the AI tool if it chooses a different strategy from the ones in the input parameters but the outcome will be the same?*
4. **Arguments to use an AI tool in negotiation:** Here, participants were asked to mark their response that best corresponds to their opinion for each of the following statements. In this case, more than one answers could be applied.
- 4.1. *Assist you in order to make the best deal*
 - 4.2. *Provide useful info related to an ongoing negotiation*
 - 4.3. *Plan a strategy depending on its suggestions*
 - 4.4. *Earn extra time to deal with other important negotiations*
 - 4.5. *Be able to focus on more strategic initiatives*
 - 4.6. *Save money due to the lack of attention and time*
5. **Credibility of AI tools:** This section included the rating of questions/ arguments related to the credibility of AI tools. This includes things like knowing more about the AI's architecture, trustful issues on potential suggestions, software's interface and more.
- 5.1. *Do you consider that the use of an AI tool may give to a third party access to sensitive data?*
 - 5.2. *Do you consider that the use of AI tools in negotiations might replace humans?*
 - 5.3. *Do you consider that the use of AI tools will provide better strategies?*

- 5.4. *Do you consider that the use of AI tools will provide better results?*
- 5.5. *Do you trust an AI platform as a decision-making tool for negotiations within the Supply Chain?*
- 5.6. *Do you trust an AI platform as a decision-making tool for other applications (i.e. healthcare)??*
- 5.7. *Do you believe that AI tools manipulate a decision-making?*
- 5.8. *Do you believe that manipulation happens due to the human factor?*
- 5.9. *Do you believe that manipulation happens due to the learning process of the tool?*
- 5.10. *Do you believe that manipulation happen due to non-complying of the AI tool with ethical standards and legal regulations?*
- 5.11. *Would you prefer to interact/ guide the AI tool in decision-making cases?*
- 5.12. *Does the software's environment (i.e. user friendly) affect your trust to AI?*

Moreover, participants were also asked what are their major concerns about the use of AI tools. A set of arguments were presented, like "be out of work", "break the law", "limited access to the process flow", "potential manipulation of the decision making", "not familiar with technology", "if the decision is reliable" and "violation of human rights". They had also the option to fill their own concerns.

Depending on these concerns, we generated a question related to what participants think is currently missing from AI-tools in order to be trusted and applied in negotiation strategies in supply chain operations. Here, they could choose between "ethical/ legal regulations", "Human inspection point", "Human involvement on the tool's process flow", "Ability to negotiate in real-time", "Technological advances", "Understanding how the tool operates" and "Having a user-friendly interface".

6. **General about AI:** The last section of the survey including a trust rating of AI tools in various applications fields. The purpose here was to see what participants think about other applications of the AI technology and if they would trust in for decision making within these areas. The areas included Agriculture, Healthcare, Human Resources, Finance, Lifestyle, Manufacturing/ Production, Security, Supply Chain, Surveillance, Personalized services (like ads, news, social media content, etc.), Research and Development, or any other. Additionally, the participants were asked some generalized questions.

- 6.1. *Do you know that there are companies where part of the work is handled by AI tools?*
- 6.2. *Do you know that there are companies where negotiations with suppliers and/or customers are handled by AI tools?*
- 6.3. *Would you be comfortable sitting in a room during a negotiation process where the other party is using an AI tool for decision-making?*
- 6.4. *Would you be comfortable sitting in a room during a negotiation process where the other's party AI tool is using cameras and sensors in order to monitor your expressions?*

In the goodbye section there was an option for participants to provide any additional feedback on AI tools for negotiation strategies within the Supply Chain ecosystem.

The survey utilized mostly a Likert scale (Vasileiadou 2023), with the exception of the feedback section and a couple of questions where participants had multiple options on predefined statements. The Likert scale is a fundamental and widely used psychometric tool in educational and social sciences research (Jebb, Ng, and Tay 2021; Joshi et al. 2015). It uses a set of statements, where participants are asked to show their level of agreement (in our case from strongly disagree to strongly agree) with the given arguments on a metric scale. It is an easy to implement method and simplifies the analysis process. Here, we will apply a 5-point statement symmetric scale (1. Strongly Disagree, 2. Disagree, 3. Neutral, 4. Agree and 5. Strongly Agree). In a symmetric scale the point in the middle is neutral. It is stated that Likert scale is considered as one of the best tools in various fields for measuring opinions in surveys, attitudes and behaviors (Sullivan and Artino 2013).

Questions were stated in such a way to align with the two basic objectives of this work; The exploitation and trust of AI tools in negotiation processes within the supply chain ecosystem. Upon the completion and inspection of the survey, it was disseminated towards people that are actively involved in the supply chain ecosystem or developing AI tools for negotiation activities in the supply chain. This approach allowed us to gather insights from both practitioners and developers, providing a comprehensive understanding of current trends and practical applications from diverse perspectives.

In the following table, we apply an old-school survey design for our study case (Groves et al. 2009).

Table 6: Framework of the survey

Sponsor	No sponsor
Collector	Hellenic Open University
Purpose/ Objective	1) Exploit negotiation strategies by using AI tools 2) Trust AI tools for negotiation strategies
Date Started	May 2024
Target Group	Professionals in Supply Chain Activities
Sampling Frame	People working in Supply Chain Operations and Management, Production and Manufacturing, Academics and Specialists in Supply Chain that are using AI tools for negotiation strategies
Sample Size	At least 50 participants
Use of Interviewer	No Interviewer was used
Mode of Administration	Web-page, multi-choice questions
Computer Assistance	Yes
Reporting Unit	Randomly Selected Adults
Time Duration of Survey	12 min
Time dimensions	Non-repeatable
Frequency	Conduct once
Web link	https://docs.google.com/forms/d/e/1FAIpQLSd2mcbIzqLMkmAuZuqSyz_PWfhZXGLGQwuV-duMjfvIW81xAA/viewform?vc=0&c=0&w=1&flr=0&usp=mail_form_link
Used Scale (Likert)	Likert Scale, 1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree

3.3 Data Analysis

The primary objectives of this work are to understand the experience of the population that is using AI tools in the supply chain operations and what are the major concerns of the population for trusting these systems. The received data are both quantitative (multi-choice responses) and qualitative (feedback from the participants).

Since, the sample population size needs to be at least 50 participants, I will use a frequency analysis method to interpret the collected data. Frequency analysis is based on statistics and consists the counting of the occurrence of each response per question that was given in the survey. In other words, it involves the analysis of values distribution within a given dataset. It offers valuable information related to patterns, tendencies and variations inherent in the data. By using frequency analysis, we can easily identify common values, outliers, and trends, facilitating informed decision-making. This analytical method is a powerful tool for researchers in various fields, facilitating the extraction of meaningful insights from raw data.

However, the Statistical Analysis method has also its weaknesses. Here, I can foresee that a larger statistical population that the 50 participants stated in the design table (for example 500), would yield more accurate results. Also, given the fact that this is an anonymous survey, we might have responses from people not related to the Supply Chain ecosystem (industry or academia) or people related but not having a prior experience with AI tools.

In order to overcome these weaknesses, I will firstly support the findings with the current state of the art literature. For the statistics, in order to ensure the credibility of the responses, I will use Cronbach's Alpha calculation method. Cronbach's alpha (α) statistic is regularly reported in science studies and is a way to measure the internal consistency of a questionnaire or survey. It ranges usually between 0 and 1. However, higher values indicate that the survey is even more reliable (Barbera et al. 2021; Taber 2018).

Table 7: Cronbach's alpha range

Cronbach's Alpha	Internal consistency
$0.9 \leq \alpha$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable

$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

Indeed, there are other methodologies that I could follow for the raw data analysis, like performing descriptive statistics in order to determine the central tendency of responses or a correlation analysis where I would try to find how the survey's statements are connected. I firmly believe that chosen the aforementioned analysis, leads to a credible conclusion about the objectives of this work, without making the analysis more complex. Additionally, I hypothesize that the number, type and format of questions should have stated differently, in order to support better the other proposed methodologies.

4. Results

In this chapter, I will present the results from the submitted surveys. These are the statements/ answers the participants provided for each argument. Additionally, part of the feedback or comments will be also stated here. The responses will be presented in a graphical way, while the comments in tabular format. Any furthermore analysis of the raw data, will take place in the next chapter. In total, 90 participants took the survey.

4.1 Demographic Information

The demographic section included questions about the gender, age group and education level of the participants. Additionally, we asked them in which department do they work, what is their job seniority, as well as the total years they are employed in the supply chain ecosystem.

Table 8: Gender information of the participants

Female	42
Male	41
Non-binary or other genders	0
I prefer not to answer	1

Table 9: Age group information of the participants

Under 25	0
25-24	26
35-44	44
45-54	18
55 and over	2

Table 10: Education level of the participants

High school or less	1
University degree	21
MSc degree	45
PhD degree	21
MBA	2

Table 11: Department where participants work

Customer Service	6
Human Resources	2
Logistics	7
Academia/ R&D	22
Procurement	14
Production/ Manufacturing	17
Sales	6
Other	16

Table 12: Level-seniority of the participants

Entry-Level	14
Mid-Level	32
Senior Level	33
Management	10
Executive	1

Table 13: Total years of experience in the Supply Chain ecosystem

Less than 5	45
5-10	22

11-20	19
21-30	3
More than 30	1

4.2 Current Practices

In the current practices section, the participants had to rate a set of questions and choose from a Likert scale 5 statements (1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree and 5 – Strongly Agree) regarding the use of AI tools at their company. They were asked to mark the response that best corresponds to their opinion for each question with a dot (•). I should comment here that the same pointing system is used for the rest of the survey.

Table 14: Statements related to the current practices of the participants

#	Question	Likert Scale				
		1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)
2.1	Do you trust AI tools?	0	19	43	26	2
2.2	Are you using an AI tool for your professional tasks?	21	26	21	19	3
2.3	Are you using an AI tool outside of your work?	20	23	21	23	3
2.4	Does your company use AI tools for its daily operations?	32	28	16	10	4
2.5	Does your company own an AI tool license?	52	18	11	6	3
2.6	Is your company discussing to purchase an AI software license tool?	36	22	20	9	3
2.7	Do you believe that you benefit from the use of an AI tool?	2	7	41	27	13

2.8	Are you comfortable with the use of an AI tool?	2	16	33	35	4
2.9	Are you confident with the provided outcome from an AI tool?	3	24	43	19	1
2.10	Do you agree with the use of AI tools at your work?	3	13	32	34	8
2.11	Are you familiar with the risks of an AI tool?	10	20	26	26	8
2.12	Are you using an AI tool to assist you on decision making?	37	26	15	11	1
2.13	Are you allowing an AI tool to make a decision for you?	53	27	9	1	0
2.14	Are you allowing an AI tool to make a decision for you as long as there is a check-point by a human?	24	23	16	22	5
2.15	Would you like to learn more about AI tools?	1	2	9	39	38

Participants were also requested to provide information related to the use of any AI tools for their professional tasks.

Table 15: AI tools used from participants in their professional tasks

Blue Yonder	1
ChatGPT	77
Coupa AI	2
GitHub Copilot	14
Google Bard	18
HubSpot	4
IBM Watson Supply Chain	1
Logility	1

OneFlow package	2
Oracle AI	3
Pactum suite	0
Perplexity AI	3
SupplyShift	0
ThroughPut AI	10
Zendesk AI	7
Other	6
None	6

4.3 Applying an AI tool during negotiations

In this section we presented to the participants a hypothetical scenario. According to the scenario, they work in a company which decides to purchase an AI platform to negotiate its suppliers and customers. Participants are requested to respond to a set of questions related to the use and trust of the AI tool during negotiation processes.

Table 16: Use and trust of AI tools from the participants during a negotiation process

#	Question	Likert Scale				
		1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)
3.1	Would you trust the AI tool to deal with low-risk negotiations?	11	23	31	19	6
3.2	Would you trust the AI tool to deal with high-risk negotiations?	41	30	17	2	0
3.3	Would you bypass the AI tool and negotiate directly with the other parties when you do not agree with the tool's outcome?	5	10	22	21	32

3.4	Independently of the risk, would you use the AI tool in the case where your manager puts a pressure to complete a negotiation?	14	18	37	15	6
3.5	Independently of the risk, would you use the AI tool in the case where there is no time to go through the terms of a negotiation by yourself?	13	24	27	23	3
3.6	Will you enable the AI tool during a negotiation that does not go well?	16	25	27	19	3
3.7	Will you disable the AI tool during a negotiation that seems to move towards a different strategy (but doesn't mean that it will go)?	6	15	41	20	8
3.8	Will you disable the AI tool if it chooses a different strategy from the ones in the input parameters but the outcome will be the same?	6	22	37	17	8

4.4 Arguments to use an AI tool in negotiation

Here, we asked the participants to select from a predefined list of arguments regarding the application of AI tools in negotiation strategies. Participants had the option to provide more than one answers.

Table 17: Arguments related to the use of AI tools in negotiation

#	Argument	Participants
4.1	Assist you in order to make the best deal	49
4.2	Provide useful info related to an ongoing negotiation	60
4.3	Plan a strategy depending on its suggestions	51
4.4	Earn extra time to deal with other important negotiations	46
4.5	Be able to focus on more strategic initiatives	38

4.6	Save money due to the lack of attention and time	40
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4.5 Credibility of AI tools

One of the major issues as we described in the literature review chapter, is the fact that people have specific reasons to not using or trusting AI tools. Thus, we examine what the professionals think and state, related to the credibility of these systems.

Table 18: Use and trust of AI tools

#	Question	Likert Scale				
		1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)
5.1	Do you consider that the use of an AI tool may give to a third party access to sensitive data?	5	17	16	36	16
5.2	Do you consider that the use of AI tools in negotiations might replace humans?	13	19	23	29	6
5.3	Do you consider that the use of AI tools will provide better strategies?	3	19	37	23	8
5.4	Do you consider that the use of AI tools will provide better results?	4	18	39	25	4
5.5	Do you trust an AI platform as a decision-making tool for negotiations within the Supply Chain??	11	30	38	10	1
5.6	Do you trust an AI platform as a decision-making tool for other applications (i.e. healthcare)??	19	27	32	12	0
5.7	Do you believe that AI tools manipulate a decision-making?	5	25	36	22	2
5.8	Do you believe that manipulation happens due to the human factor?	5	12	28	29	16

5.9	Do you believe that manipulation happens due to the learning process of the tool?	4	19	29	27	11
5.10	Do you believe that manipulation happen due to non-complying of the AI tool with ethical standards and legal regulations?	4	16	34	23	13
5.11	Would you prefer to interact/ guide the AI tool in decision-making cases?	7	12	26	29	16
5.12	Does the software's environment (i.e. user friendly) affect your trust to AI?	6	18	31	25	10

Next, we collected the answers related to the concerns of the AI tools usage in various applications as well as what participants think that is missed from these systems.

Table 19: Concerns related to the use of AI tools

#	Question	Likert Scale				
		1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)
5.13	Be out of work	14	16	26	17	12
5.14	Breaking the law	13	18	20	22	13
5.15	Limited access to the AI's process flow	5	12	29	27	13
5.16	Manipulation of decision	4	10	33	26	13
5.17	Not familiar with technology	20	22	26	10	6
5.18	Reliable decision	3	10	32	23	17
5.19	Violation of human rights	5	15	22	21	21

Table 20: Missing parts from the AI tools

#	Question	Likert Scale				
		1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)
5.20	Ethical and Legal regulations	3	7	22	29	29
5.21	Human check-point on final decisions	1	6	17	32	34
5.22	Human involvement on the tool's process flow	3	14	28	23	22
5.23	Negotiation in real-time	6	15	30	23	16
5.24	Technological advances	8	26	31	14	11
5.25	Understanding how the tool operates	3	13	23	31	20
5.26	User-friendly environment	5	15	41	21	8

4.6 General about AI

A set of more generalized questions related to the use of AI in other fields were examined by the participants. This included the trust of the participants towards other fields where AI is used.

Table 21: Generalized fields where AI tools are widely used

#	Would you trust an AI tool for applications in	Likert Scale				
		1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)
6.1	Agriculture	2	12	22	35	19
6.2	Healthcare	8	29	32	17	4
6.3	Human Resources	12	30	27	17	4
6.4	Finance	6	13	30	30	11
6.5	Lifestyle	11	12	24	26	17

6.6	Manufacturing/ Production	4	9	27	33	17
6.7	Security	7	21	29	23	10
6.8	Supply Chain	3	14	36	28	9
6.9	Surveillance	8	14	28	31	9
6.10	Personalized services (like ads, news, social media content, , etc.)	5	11	26	26	22
6.11	Research and Development	8	16	27	29	10
6.12	Other	41	9	29	5	6

Table 22: Generalized questions

#	Question	Likert Scale				
		1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)
6.13	Do you know that there are companies where part of the work is handled by AI tools?	9	15	16	28	21
6.14	Do you know that there are companies where negotiations with suppliers and/or customers are handled by AI tools?	19	21	22	20	7
6.15	Would you be comfortable sitting in a room during a negotiation process where the other party is using an AI tool for decision-making?	31	21	24	11	2
6.16	Would you be comfortable sitting in a room during a negotiation process where the other's party AI tool is using cameras and sensors	50	24	9	4	2

	in order to monitor your expressions?					
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4.7 Additional Feedback on AI Tools for negotiation strategies within the Supply Chain Operations

People shared a variety of thoughts through the additional feedback field. I will mention the most interesting comments among the 90 recorded.

Table 23: Selected comments and feedbacks

#	Comment/ Feedback
1	We need time for the AI tools to see how they will eventually perform and with what results. May they can help in some sectors.
2	I prefer not to use AI for negotiations
3	AI can be tremendously helpful but us humans not being familiar yet with all the potential, can lead to scary scenarios.
4	AI tools, algorithms and machine data learning lead the way to solve new problems, business issues and tasks with data-driven predictions. Trustworthy AI systems is key priority. We need it and we can achieve it. Since AI systems will exist alongside humans as invaluable sidekicks, it is crucial to understand how they work. Thus, the training loop, in terms of data preparation-modelling and deployment should be improved constantly in order to optimize the performance of the model.
5	Very interesting research! AI tools are something brand new and I believe that the companies in Greece have just started exploring, while in other countries is already a reality. I believe it can grow if ethical rules are applied.
6	I hope the results of this survey won't be analyzed purely by AI tools.
7	Not use AI tools without thinking

5. Discussion

5.1 Demographic Information

90 participants took the survey. According to the demographic results, I noticed that there is a balance between female and male participants, while a 1% declared the preference not to answer the gender question.



Figure 7: Gender information of the participants that completed the survey

There is an age distribution between 25 and 54 years old, while only a 2% is above 55 years old. On the other hand, none of the participants were below 25 years old. Nowadays this is close to the average age someone has upon graduating with an MSc degree and is applying to job openings. Thus, I hypothesize this is among the reasons that we do not have any participant at this age group. Additionally, the dissemination of this survey took place mostly through LinkedIn, Facebook and email. People in the age group under 25 uses other platforms, thus there is a case that it didn't reach young professionals.

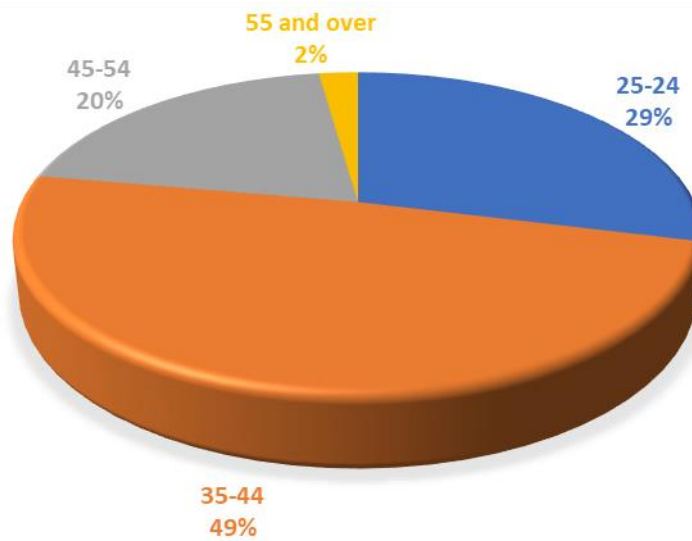


Figure 8: Age group information of the participants that completed the survey

The next pie chart depicts information related to the education level of the participants. Half of them have an MSc degree, while the other almost two quarters have either a graduate or PhD degree. 2% state that have an MBA, while 1% have completed high school or received less education.

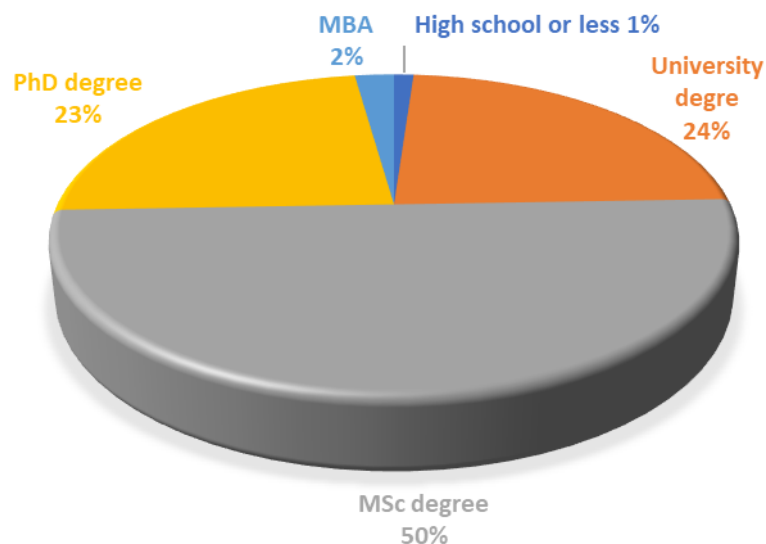


Figure 9: Education level of the participants that completed the survey

The survey participants hold various positions within the supply chain field. A 56% is engaged in Customer Service, Logistics, Procurement, Production/ Manufacturing and

Sales. 24% are occupied in Academia and R&D. I should comment here that these are mostly academics occupied in the Supply Chain, software developers that are involved in developing AI tools and researchers who's part of their daily tasks include managing supply chain activities. The last 20% part includes individuals that stated as professional department Civil Engineering, Construction, Human Resources, Quality Assurance, Administration, Engineering, Healthcare and Shipping Industry.

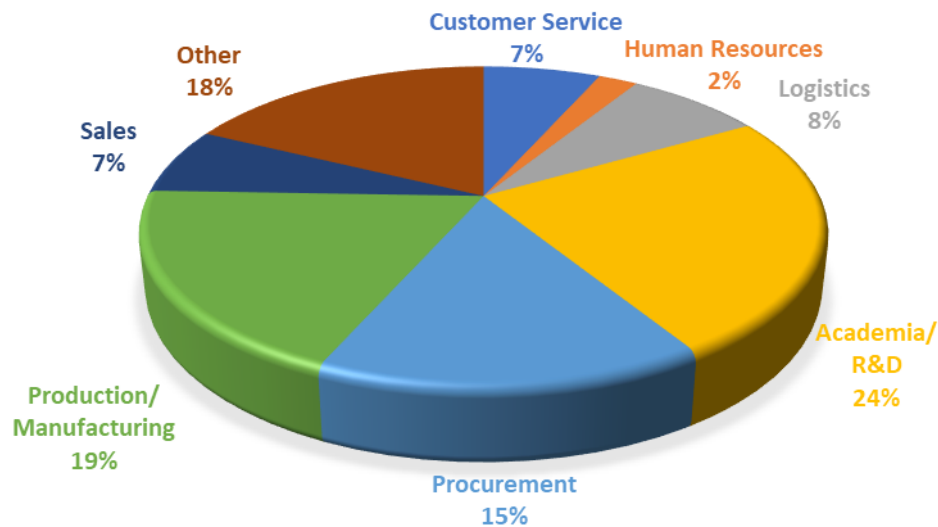


Figure 10: Participants' professional department

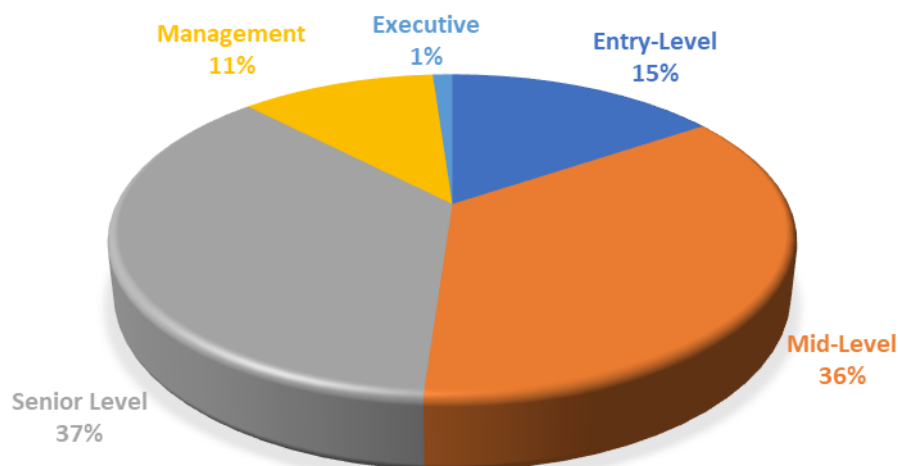


Figure 11: Seniority-level of the participants that complete the survey

The target group was asked about their level of seniority within their respective enterprises. The majority possess either a mid or senior level position. 11% are defined as managers, 15% are in their early professional stage and 1% are in the executive level. Related to the experience of the participants, I notice that half of the population is considered as experienced, while the other half is going through its first years of work within the supply chain ecosystem.

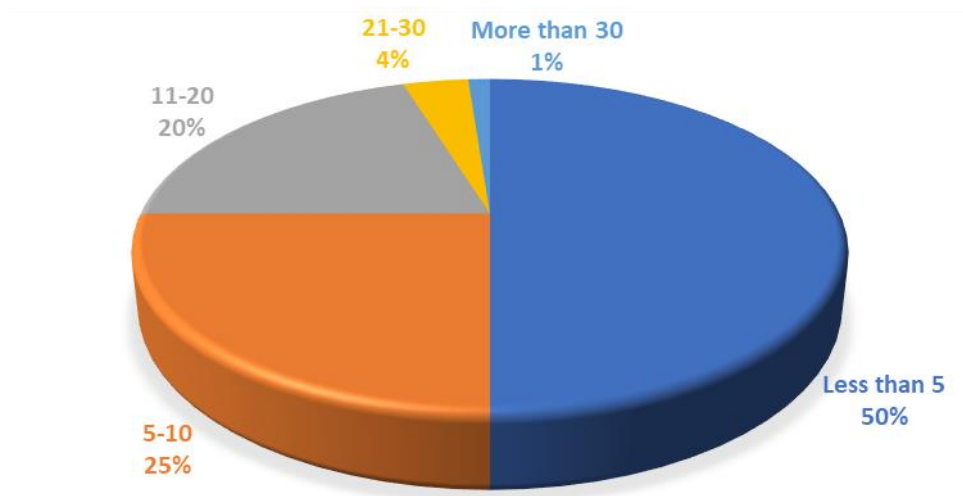


Figure 12: Years or experience of the participants having in the Supply Chain ecosystem

According to the aforementioned chart-pies, I have indeed a solid population group, including high and less experienced professionals, of various ages and seniority level. 99% of them, have a graduate degree and 76% of them have at least an MSc.

5.2 Current Practices

The first section of the questionnaire included questions related to the use and trust of AI tools. Participants tend to demonstrate a major neutrality related to trusting AI tools. I believe that this neutrality might come from the fact that 52% disagree or strongly disagree in using AI tools for professional tasks, while another 23% are in the neutral zone. Similar results are shown also in the responses in the use outside work.

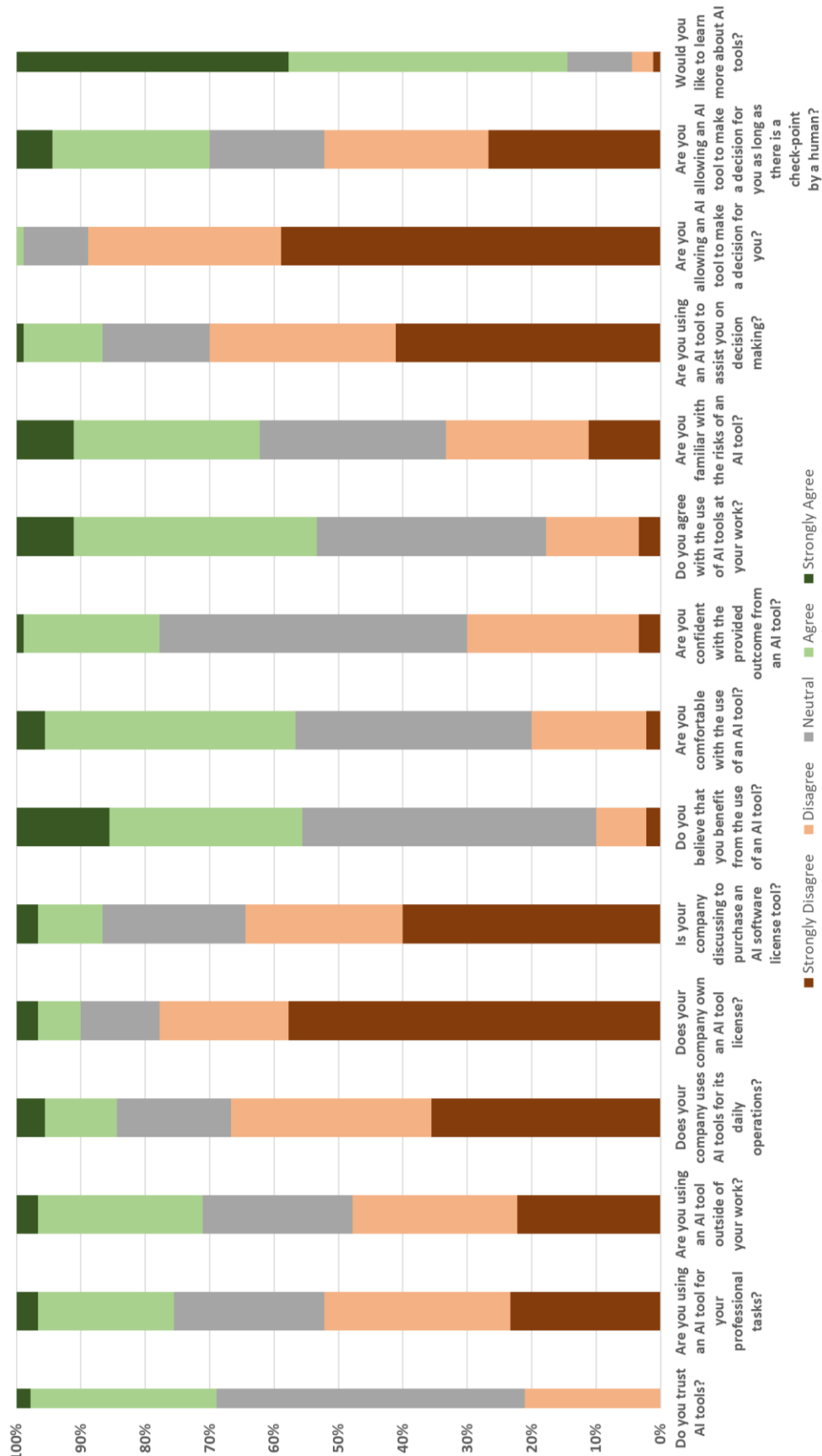


Figure 13: Responses related to the current practices questions

Unfortunately, only an 11% work in companies that possess license of AI software. Similar low percentages state that their business uses AI tools in daily operations and that there are discussions within the management to purchase a license for an AI system. An almost 45% agree that they benefit from the use of an AI software, while another 45% are in the middle of the Likert scale.

One key factor in the adoption of AI tools for negotiation strategies is the user's level of comfort. According to the survey, 42% of participants agree that feeling comfortable with these tools is crucial, while another 37% remain neutral on this issue. However, the population seems not to be confident with the generated outcome of the AI tool. 31% disagree, while an almost 50% are the middle zone of the Likert scale. Moreover, the strongly agree participants represent only a 4%. However, there is a general positive attitude towards using AI tools at work. It would be interested in the future, to suggest a furthermore analysis to determine the specific tasks where employees are most likely to apply these tools. Especially, since there is a clear disagreement in using the AI tools for decision making purposes (either directive or assistive). Even when there is a human check point, again participants seem uncomfortable to rely on the tool's decision.

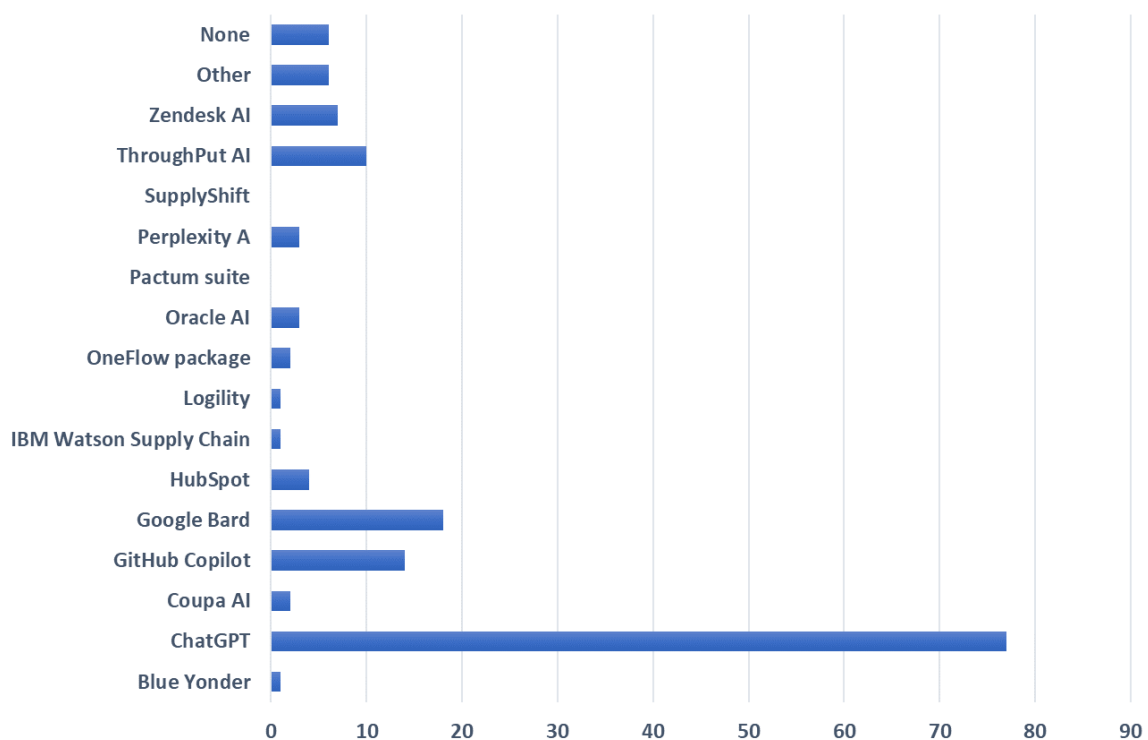


Figure 14: AI tools that participants use at their work

To conclude the second section of the discussion, we observed that the population is not familiar with the risks this technology possesses, while more of 85% would like to be updated on the AI tools. Unfortunately, among the participants only a few are using licensed AI suites designed for negotiation applications (mostly in contract agreements).

5.3 Applying an AI tool during negotiations

Here, we will discuss the results from the hypothetical scenario where the enterprise has purchased an AI software license and the population has to negotiate with suppliers and customers. Similarly, we see that there is a pattern towards the trust of the AI tool for both low and high-risk negotiations. Especially for the latter, participants disagree in the remarkable almost 80% of not using it. Only 28% agree to trust the outcome results in low-risk negotiations, which drops majorly to 2% in the case where negotiations are considered as high-risks.

This mistrust is proven also from the fact that participants would bypass the tool's decision and negotiate directly with the other party, if they do not agree with its flow. On the other hand, they prefer not to enable the AI tool when the negotiation is not going well. In the case of pressure, either by their manager or time, the results are similar; In both cases participants disagree on using the tool.

The last two questions are related to the applied strategy of the AI platform. In the first case, the AI tool decisions seem to might move towards a different strategy during a negotiation, while in the second the software weights the strategy and decides to change it by keeping the final outcome the same. Here, we see a relative balance between the agree and disagree statistics, with the majority of the population being in the neutral zone.

Unfortunately, we noticed one more time that individuals have a trustiness issue with the AI tools. Despite the fact, that an AI system could provide useful insights during a negotiation and choose a flow driven by data, people seem to be quite cautious upon its application.

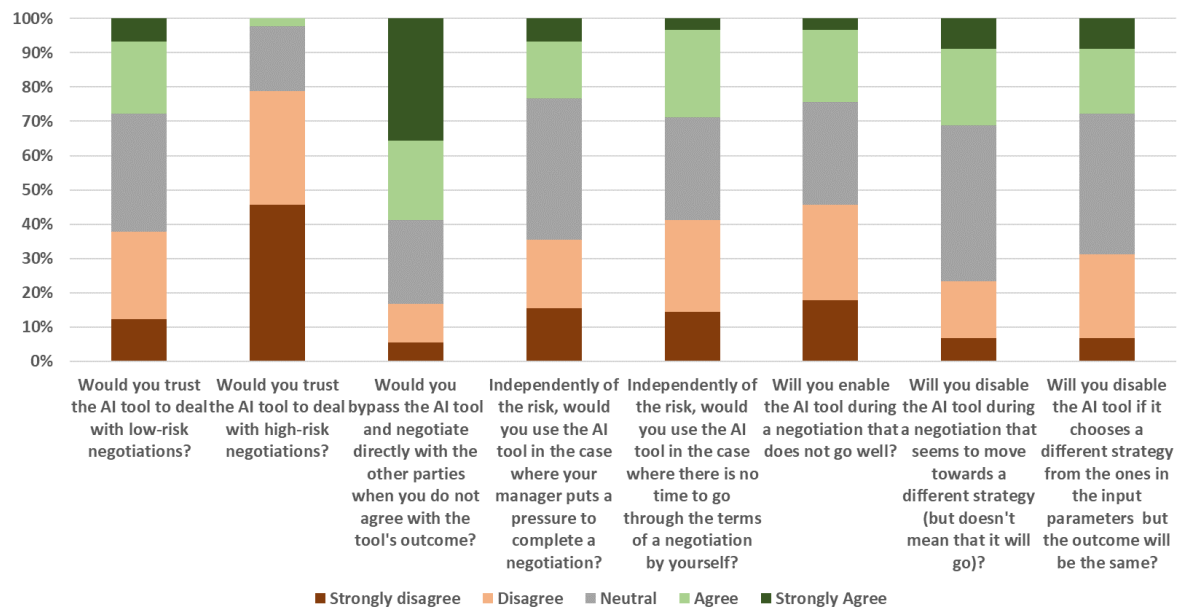


Figure 15: Responses related to the application of AI tools during negotiations

5.4 Arguments to use an AI tool in negotiation

In this section, we asked participants a set of arguments in the use of an AI platform. It is observed that none of the arguments reached the maximum responses (which is equal to the number of participants, 90). It seems that the strongest argument is the provision of useful info related to an ongoing negotiation, which reaches almost 70% of the replies. On the other side, the less voted argument is the ability of the AI platform to do work in order for you to focus on more strategic initiatives. Also, participants are not convinced that the tool could actually save them money, due to people's lack of attention and time when having to deal with multiple negotiations. However, we do not have insight info related to the company size. Thus, if we are referring to small-size companies where most of the work is successfully handled by the employees, it could explain the low percentage of this argument. Despite the fact that we tried here to state the most important motivations on the application of AI systems, still they might exist other arguments from using them.



Figure 16: Responses on the arguments to use an AI tool in negotiation

5.5 Credibility of AI tools

The aim in this section is to discuss the credibility that AI tools have according to the participants. One of the most concerns that people have is the dissemination of their sensitive data by the use of AI platforms. 59% agree that a third party might gain access to these valuable data.

It seems that there is a balance between agree and disagree responses in the consideration that AI tools might replace totally humans in negotiation activities. I hypothesize here that the responses depend strongly on the way AI tools are applied. An experienced to AI person that has used AI suites, like Pactum or Oneflow package, knows the capabilities of this technology related to non-users. The same balanced response, with a minor increase in the neutral zone, is also noticed in the argument if the AI systems will provide better strategies and results in the negotiation process.

Again, people are having difficulties in trusting the system for decision making, which is proven from the fact that almost 90% either disagree or stay neutral for Supply Chain activities. Especially, in this statement there is just one single response in the strongly agree part of the scale.

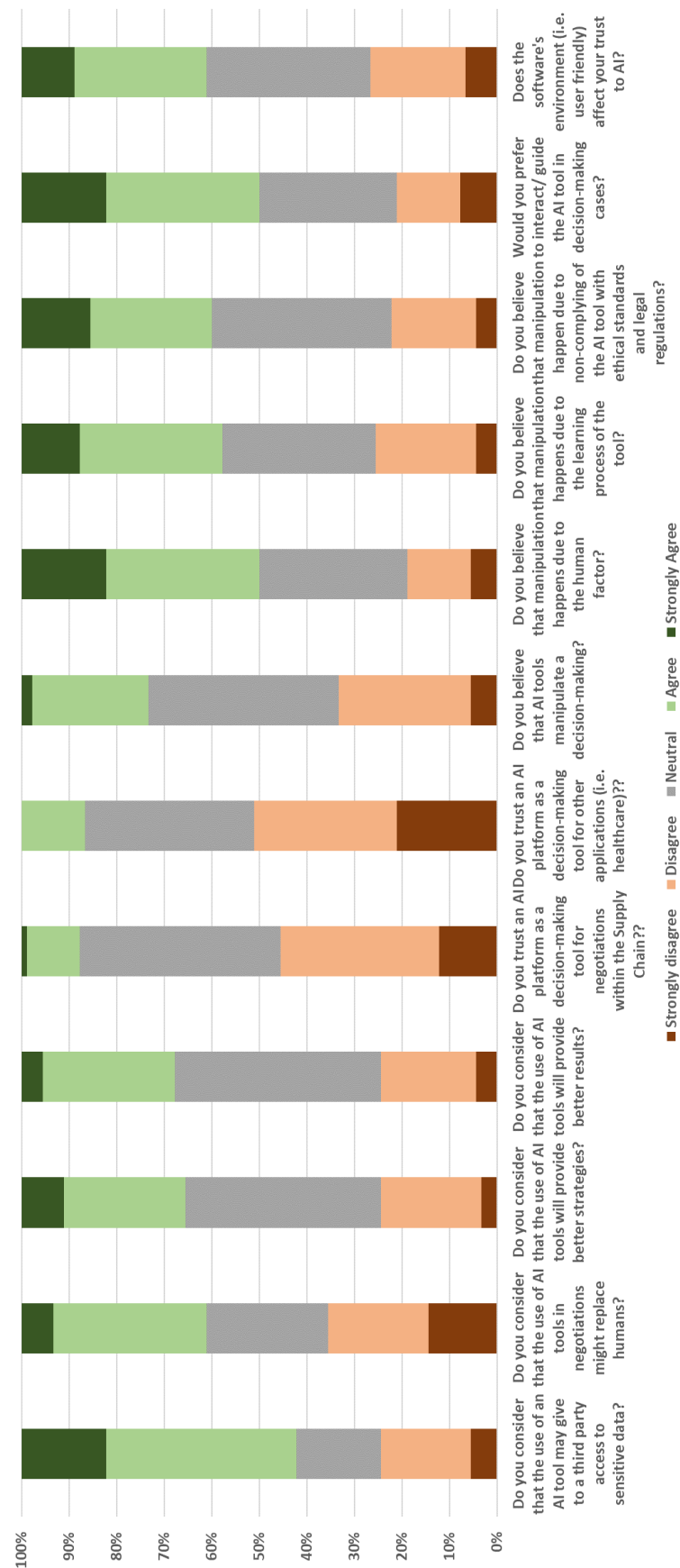


Figure 17: Responses on the credibility of AI tools

Moving to the case where these tools might provide biased or manipulated results it seems that there is pattern where participants believe that it is doable to affect the decision. Moreover, they agree that for the manipulation might be responsible either a human factor or the non-complying of the AI tools with ethical standards and legal negotiations. I believe these are the reasons that people would prefer to interact and/ or guide the tool in the decision-making cases. However, I should comment here that this is objective, as people's acts depend on both their background, experience and morality.

In the literature review, it was stated that it is important for a tool to be user friendly (Brdnik, Heričko, and Šumak 2022). On the survey, participants seem to keep a balance related to the software's environment. I strongly believe that the population here is divided in two; Participants that have used AI tools and are familiar with its operation and participants that are not. In any case, the conclusion on this is that it does not affect the trust to AI, as more important of the user interface is the architecture of the algorithm and how the program was/ is trained.

These responses on the credibility for the AI tools might rise from major concerns that people have about the use of AI. For example, in the thought that AI might take over their job in the near future, we noticed a balance, which is in agreement with question 5.2 (Fig. 17). The breaking-law issue is a slight concern, as again a balance exists. Participants seem to be more concern about the limited access they might have to the AI's process flow, as they cannot intervene in the decision making this way. Another concern seems to be the manipulation of decision, which can happen from a faulty learning process. People do not care if they are familiar with the technology but they do care to have a reliable decision and of course not to violate any human rights.

In order to reduce the concerns of the population we need to source and find what is actually missing from AI-tools in order to be trusted and used in negotiation strategies within the supply chain operations. Participants agree that tools should be regulated according to ethical and legal matters. Also, at least one check-point by a human or even involvement on the tool's process flow should be added in order to ensure the best outcome result during a negotiation process. Apparently, understanding tool's operation plays a crucial role and it could help negotiations design a better strategy. On the other hand, negotiation in real-time, technological advances and a user-friendly environment seem not to concern the population sample for the moment.

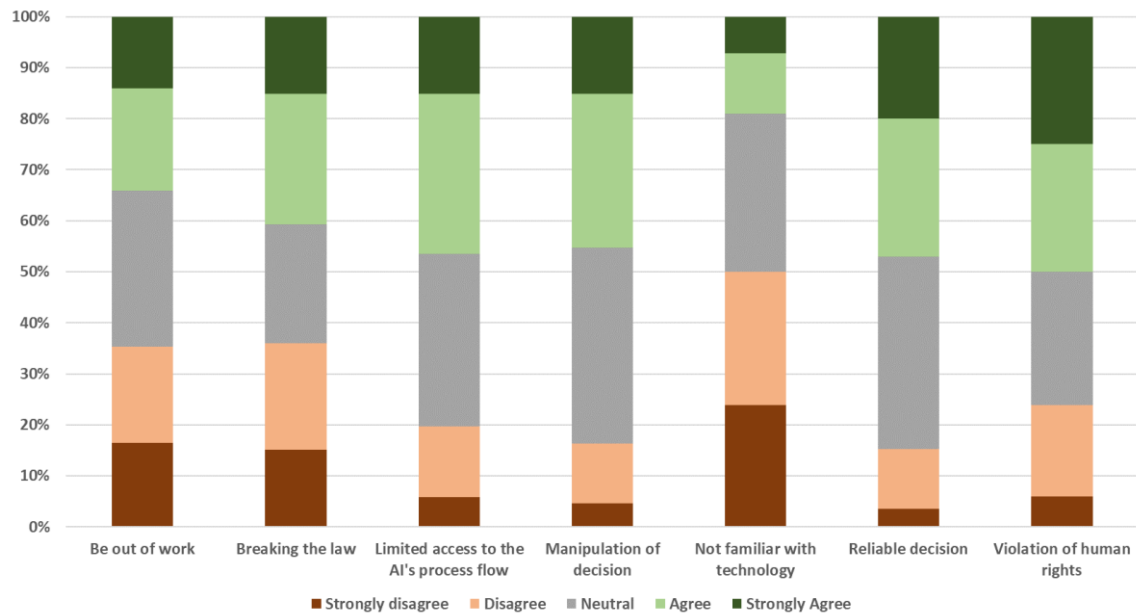


Figure 18: Participants' concerns about the use of AI tools

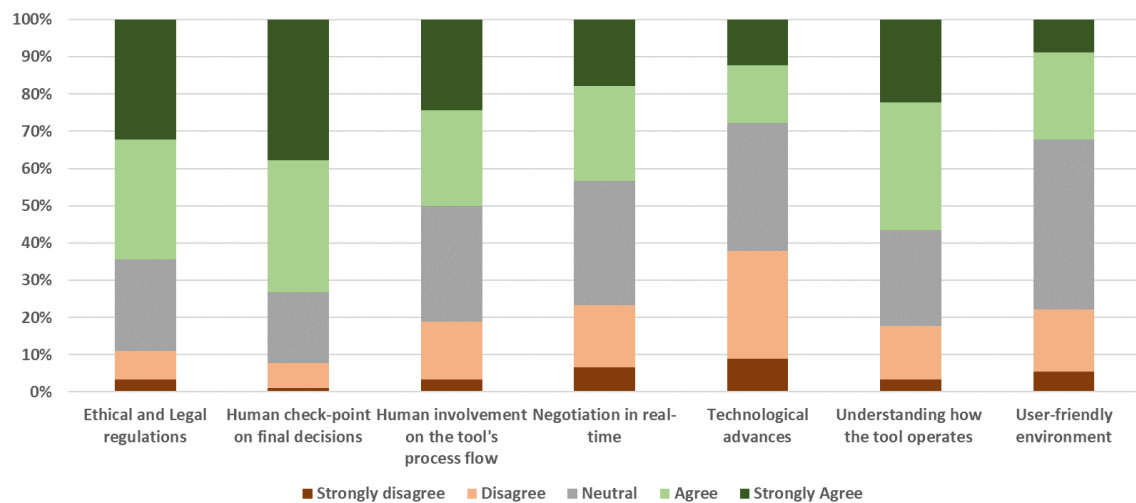


Figure 19: Concerns of participants in the use of AI-tools for negotiation strategies within the Supply Chain Operations

5.6 General about AI

In order to investigate this issue one step further and check if there is a trend in the mistrust of AI tools for other applications as well, we provided to participants a set of various

areas. This included 11 fields like Healthcare, Agriculture, Lifestyle, Finance, Surveillance and more, as well as Supply Chain and the Manufacturing/ Production as different entities.

The results demonstrate a positive attitude for the Agriculture, Manufacturing/ Production and Personalized/ Lifestyle fields when compared to other domains. It is known that AI is widely used in Agriculture for multi-applications, as they can optimize resources, increase productivity by monitoring supply chain activities and increasingly frequent weather events. It includes also crop management, prediction of disease and pest management (Oliveira and Silva 2023; Talaviya et al. 2020). The next big thing in Manufacturing/ Production is the Industry 4.0, also known as the fourth industrial revolution. This phase is actually ongoing and includes the digitization of the manufacturing sector, by the use of big data, AI, human-machine interaction and improvements in robotics (IBM 2024; What are Industry 4.0, the Fourth Industrial Revolution, and 4IR? 2022; Xu et al. 2021). Last, the Personalized field and Lifestyle is quite familiar to anyone that has a cell phone. As scrolling in various app we see personalized ads, depending on our search preferences (B. Gao et al. 2023).

Two of the areas with the lowest trust is Healthcare and Human Resources. I should comment here that for the former it was a surprise, since AI has proven its value during the last years (Alowais et al. 2023; Kitsios et al. 2023; Al Kuwaiti et al. 2023; Secinaro et al. 2021). I assume that the majority of participants are located within the Supply Chain ecosystem and potential they might not know the research advances in this area. Human resources are known for using AI systems in order to make faster the shortlisting of resumes for job openings. Here, there are high probabilities for resumes to stay out of the sorting process, due to tool's misjudgments (Murugesan et al. 2023; Nawaz et al. 2024).

The overall pattern demonstrates a similar behavior in the trust or mistrust of the AI application in various fields. The other response option, according to the participants' comments, include Automotive and Shipping industry, sports, social services, politics and law services, and fast information search.

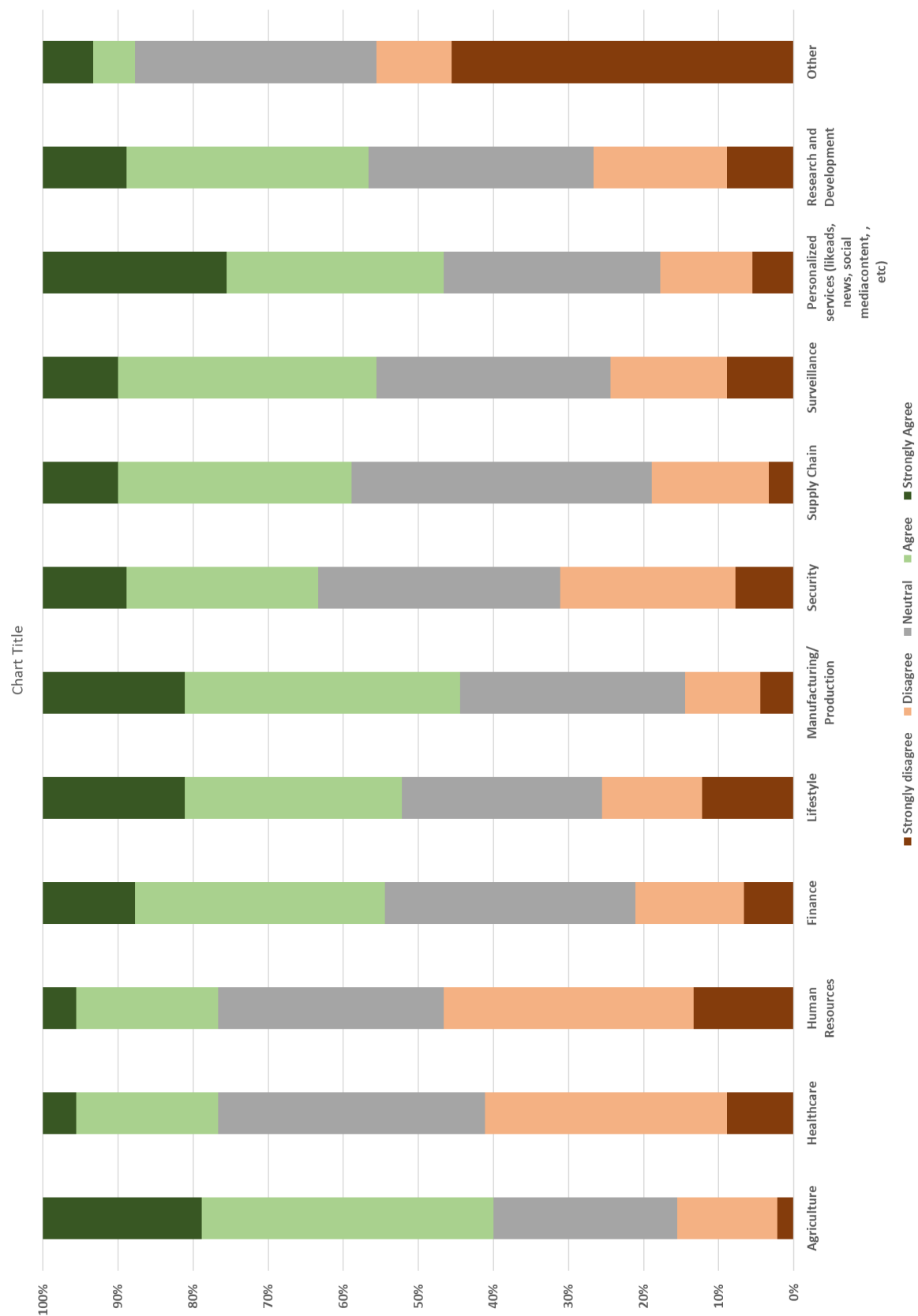


Figure 20: Trustiness of AI in various areas

The questionnaire's section is completed with four general questions. Apparently, the participants are familiar with the fact that AI handles part of the work in some companies. However, when this is applied to the supply chain environment only 28% are familiar with the use of AI tools in negotiations with suppliers and customers. Moreover, participants expressed their uncomfortability when running a negotiation activity and the other party uses an AI tool for decision making. The uncomfortability reaches 83% upon their arrival in a room where AI uses imaging and sensing mechanisms to read better the rival negotiator. I will agree with one of the comments from the feedback question that states "companies in Greece have just started exploring, while in other countries is already a reality".

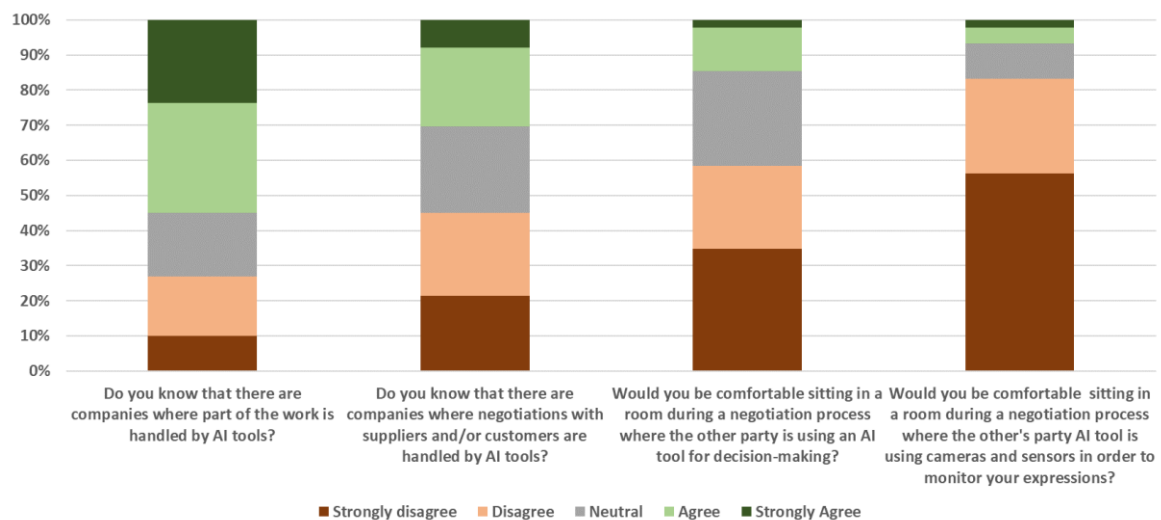


Figure 21: General questions about the use of AI tools

5.7 Cronbach's alpha analysis

In order to inspect the survey's credibility, I will apply a Cronbach's alpha analysis on the collected data from the survey. This analysis can perform in any data analysis software. In this case, I used Excel (Microsoft Office) by choosing the option "ANOVA: Two-Factor Without Replication". Input data are all the participants responses.

Table 24: ANOVA two-factor without replication analysis for the survey

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Rows	802.026879	86	9.32589394	9.0342596	3.7172x10 ³	1.266170407
Columns	1750.35650	64	27.3493203	26.494067	0	1.309996931
Error	5681.67427	5504	1.03228094			
Total	8234.05765	5654				

The Cronbach's alpha equals to:

$$\alpha = 1 - \frac{MS\ Error}{MS\ rows} = 1 - \frac{1.03228094}{9.32589394} = 0.88931024$$

Since the calculate Cronbach's Alpha is 0.889, and according to Table 7, the internal consistency of this survey is "Good". This proves also that chosen frequency analysis for the interpretation of these data was correct.

5.8 Surveys' Comparison

Here, we will discuss the results from our survey with the one that Gillespie et al. conducted (Gillespie et al. 2023). At first, we will see some basic demographics information related to the two surveys. Definitely, we cannot compare the population dynamic as in our case we have 99.5% less participants and 15 less countries than Gillespie's widely disseminated survey. The gender demographics are equal as well as we both have a good age distribution. On the education level section, our participants are located mostly in the upper graduation scale. Let's not forget that Gillespie's survey is targeting the general use of AI, while our scope is more specific and focused on negotiation strategies.

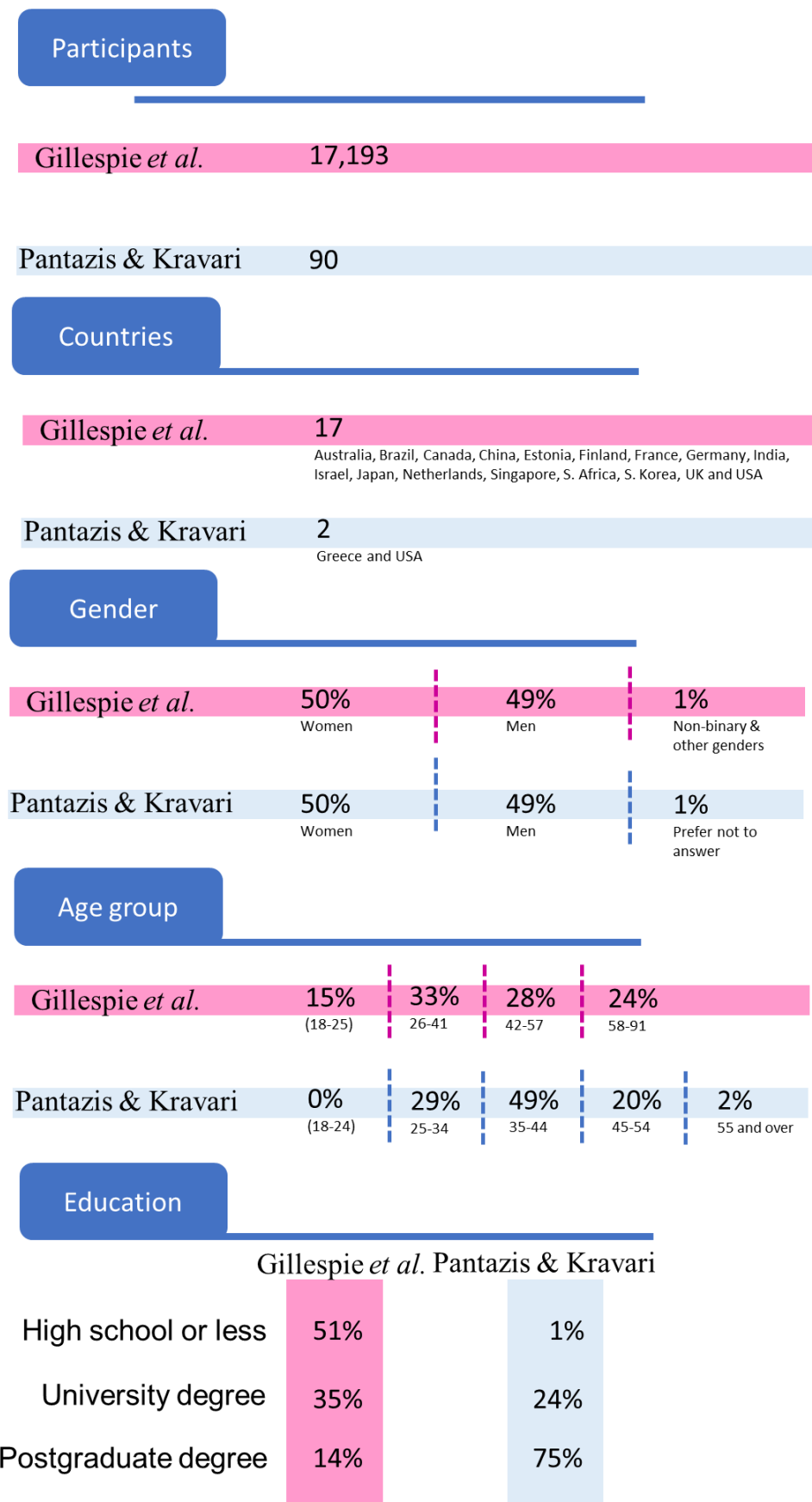


Figure 22: Comparison demographic statistics between Gillespie *et al.* and Pantazis & Kravari

However, there are basic topics related to the overall benefits, to the data privacy and how it can affect the employ of an AI tool for professional and personal use. Also, the introduction of a human agency to oversee is another issue that is discussed in Gillespie's survey.

In order to compare the quantitative responses on both surveys, we had to adjust the two different scales. We use a 5-point Likert one, while Gillespie uses across her survey 2, 3, 5 and 7 point scales. For the questions that interest us, she uses a 2 and 3-point. The 2-point scale is a yes or no system, while the 3-point can have either a Disagree-Neutral-Agree or Low-Moderate-High states. We will use the following table for the transform of the survey responses.

Table 25: Transformation of a 5-point Likert Scale to 3-and 2-point

5-point Likert Scale	5 to 3-point Likert Scale	5 to 2-point Likert Scale
Strongly Disagree	Disagree or Low	No
Disagree		
Neutral	Neutral or Medium	-
Agree	Agree or High	Yes
Strongly Agree		

I should comment that definitely there is a loss of information here, since the resolution of the responses is less than previous. However, this transformation is based on mathematical assumption, in order to be able to compare the two different surveys. For example, Østerås *et al.* made a comparison study between a 4- and 5-point system. He concluded that the construct validity and discriminative ability are comparable (Østerås *et al.* 2008). Especially this case is challenging, as the two Likert scales Østerås used are not symmetrical. In our case, the symmetry remains for the 5-to-3 point transformation. For the 5-to-2 point, I decided to not include the neutral option in the transformation. Thus, I may not get an exact quantitative analysis but in qualitative terms, we will be able to perform the comparison. In any case, there will be a small statistical error.

One of the major statements in the two surveys was if participants believe that the use of AI tools will benefit them by either assisting or providing better results to a professional task. In both surveys, the population that agrees is larger than the one that disagrees, while there is a solid percentage keeping their neutrality. Participants majorly

agree that there is a need for having assurance mechanisms in order to avoid manipulations or biased results from the application of the AI systems.

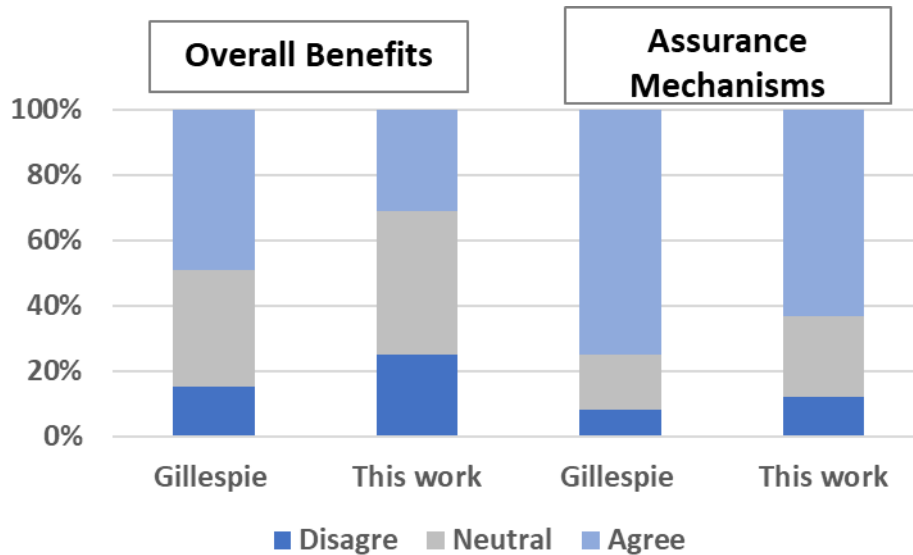


Figure 23: Comparison of the two surveys related to the overall benefits and assurance mechanisms

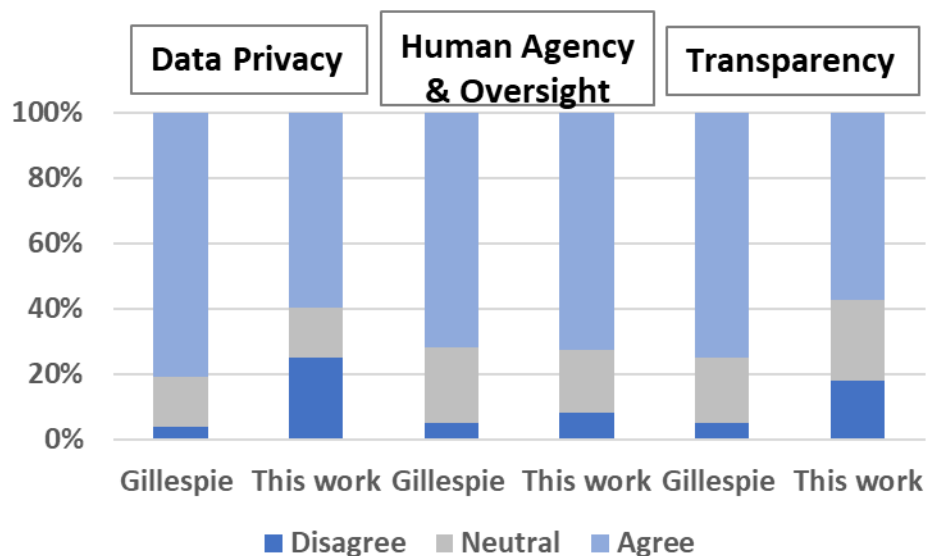


Figure 24: Comparison of the two surveys related to data privacy, involvement of human agency and transparency of the tool

Moreover, it seems that data privacy concern both cases. However, there is a relative significant difference with the people that disagree on this. I would say that this variation is related to the target population group. In our case our group consist of professionals using

AI suites dedicated for negotiation strategies in their professional tasks, and not for personal use. Both populations have almost identical responses for the use of a human agency that will have to oversight the way the system interprets data and results in decisions. As for the transparency, we notice a same trend as with the data privacy. Again, I hypothesize that this is due to the same argument (professional use instead of personal). Another observation is that the majority of companies do not have a valid license for an AI suite that can be used in professional tasks. The difference in the statistics here might arise also from the scale's transformation I performed.

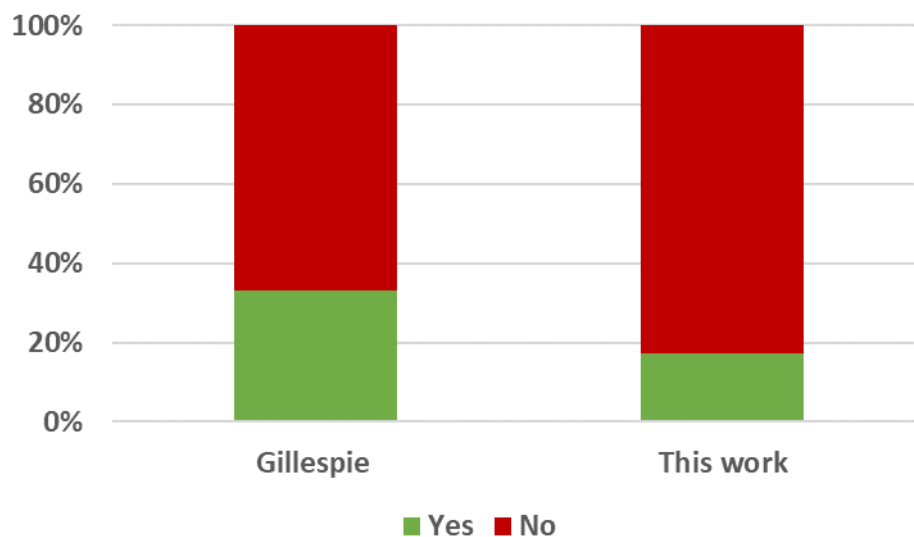


Figure 25: Use of AI tools in organization

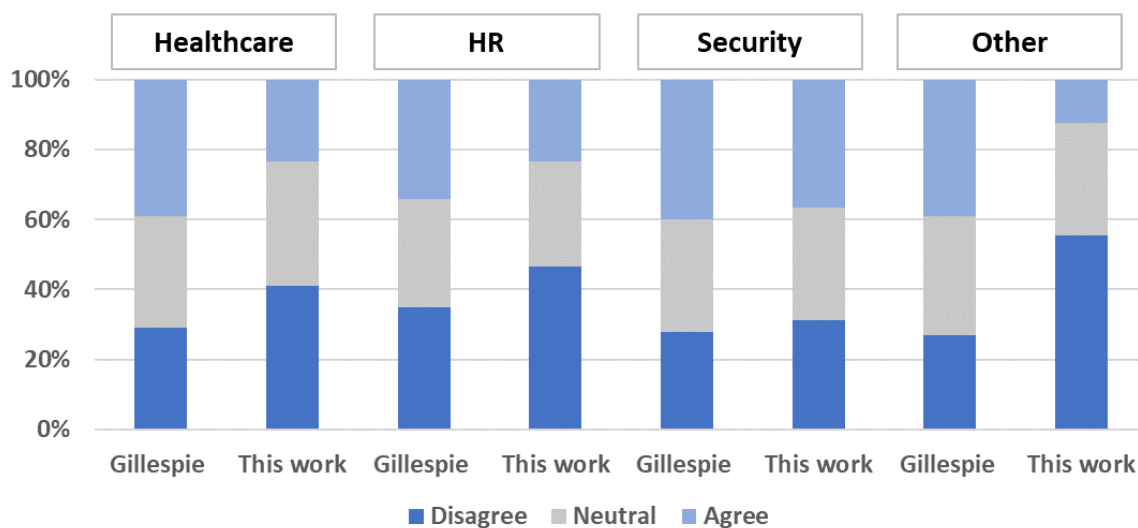


Figure 26: Comparison of the two surveys related to Healthcare, HR, Security and Other fields

Related to the use of AI in other fields, we could say that there is larger proportion in Gillespie's survey that uses AI tools. However, I will state again that this survey is more generic, while ours focuses in the supply chain environment. Thus, there are less specific AI system, used for supply chain activities. The other response seem to have a larger deviation, but this is to the smallest statistical sample of this work.

Lastly, the comparison of the surveys' results demonstrates a similar pattern for the fields of Healthcare, Human Resources, Security and Other.

6. Conclusion

6.1 Summary About This Work

Most people still think of AI as a search engine or way to write their essays, ignoring the true potential of this technology. This might be still a reason of having difficulties in trusting any other applications. We described that the human neural network has a certain mathematically way to weigh behaviors, resulting to who is trustworthy and who is not. It is easy to share a human experience with another human. Thus, an interaction between two human beings in the form of a dialogue or negotiation is easier than doing the same activities with a chatbot. Moreover, AI currently lacks of qualities that could make this technology trustful.

The improvement of negotiation strategies by using AI tools is proven through the available commercially tools. We saw how Walmart took it one step further by using Pactum's AI suite for its daily supply chain operations and negotiation activities. However, what else can we do? Improve the architecture, process flows and mathematizing of this technology. Additionally, we can focus on enhancing data integration from various sources to provide more comprehensive insights, leveraging machine learning algorithms to predict supplier behaviors and market trends more accurately. Developing user-friendly interfaces will ensure that these tools are accessible to professionals with varying levels of technological expertise. Furthermore, incorporating advanced analytics and real-time feedback mechanisms can help improve negotiation strategies. By continuously iterating on these aspects, we can push the boundaries of what AI can achieve in supply chain negotiations, ultimately leading to more efficient and effective outcomes.

The second crucial thing is for people to start trusting this technology. There are various scientific fields, where AI has already made a breakthrough. For example, examine an X-ray image and given a prognosis or prediction about cancer prior to the actual development of this medical condition. Another example is the use of AI to discover new materials with exotic properties. A need for education of the population to this promising and exciting technology, will be the first step towards a brighter future. People need a step to start developing a trust towards something unknown, that might "steal" their sensitive data as they think.

We notice from the results, that only a few companies are using for the moment professional AI tool (license) specialized for the supply chain. I would comment that there might four explanations why this is happening: 1) Enterprises are unaware of these tools that could assist them in the supply chain operations, 2) They do not trust these tools for decision making, 3) Companies cannot afford to purchase a license and 4) The workload is low, so they handle it themselves. For the latter, I would say that this the perfect time for a business to invest in such a tool as the users will have time to oversee the decision making and intervene. This could be helpful for the future where the workload might be much higher.

Developers will have to come up with mechanisms that will make the tools safer from manipulation decision. They could introduce a framework of regulations so the tool is more trustful, especially for not making decisions that will either put someone in jail or cost the company millions of euros. I think that the human involvement at this time-point is essential, as this provides to users an opportunity to work with these tools and understand them. Also, the feeling that someone inspects the process flow of the decision making is one step towards building the so precious trust.

Technological developments, most on the architecture and flow of the program will set a new era towards the advances of these tools. Especially, the role of agents will be so crucial for ongoing negotiations. For example, when choosing a strategy, you are actually choosing a set of agents that will try to succeed in this negotiation. So, they should easy adopt the input parameters in order to move towards the set requirements. AI systems should become more autonomous and improve the ability to refine through machine learning . In my opinion, I believe that the user interface environment is also vital for these tools to become public acceptable. This is not in agreement with what the survey thinks. I will state here that this might be to the fact that most of the people working in the supply chain ecosystem is using at least one software suite, so they are quite familiar.

Overall, people still do not trust AI tools for decision making, despite the fact that is based on data-driven results. Someone that might claim that there is a credibility issue, I could counter-argue with the fact that people also make bad decisions and mistakes.

In this work, we managed to investigate the trend of integrating AI tools into negotiation activities within the Supply Chain Management and Operations. Through this

analysis, we concluded with some interesting results and understood if and how AI should be utilized to either assist negotiation processes, enhance decision-making efficiency or optimize the overall supply chain performance. Let's not forget that it faces several internally and externally challenges, like the uncertainty of demand, bullwhip effect, geopolitical crisis, disruptions due to pandemics and natural disasters, and many more. Additionally, this study explored the challenges and benefits associated with adopting AI in these critical areas, providing insights into future developments and best practices. AI still lacks the ability to understand the nuances and complexity of human interactions, and the ability to provide legal advice (Ohta 2023; Sulastrri 2023).

6.2 Future Work

Developers can source many useful information that could help them to advance the technology based on feedback, like the one that we presented in this work. However, I believe that for the AI-enabled negotiation topic we need to have a specific target group with a larger statistically sample. The next step would be to interview professionals that are using AI tools for negotiation activities in order to share their experience. I would also propose to contact companies that develop these tools and get a fruitful feedback on the technology and how it is developed.

On the other hand, mathematizing the processes in a comprehensive way, like the one presented in 2.4, could assist with the development of new process flows and the right way of machine learning. The future of AI in general, and thus its applications, is defined from the future direction of AI research (Ofosu-Ampong 2024).

I have been asking myself many times if this technology will eventually drive towards a utopia or will be the end of the critical thinking for the human race? Let's not forget that the human brain was developed not to store but to process and make sense of the received information. Once the same happens with AI, then this will be the time where people will start trusting it.

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Appendix A: Questionnaire

The Questionnaire of the survey can be found [here](#).

Author's Statement:

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