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Integrating Artificial Intelligence in Supply Chain Management - Implications for Sustainability and Global Trade

Vincent Stefan Habitzreuther
58098

Work project carried out under the supervision of:

Prof. Paulo Faroleiro

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Abstract

This thesis explores how integrating Artificial Intelligence (AI) can impact Supply Chain Management (SCM) on organizational, technological, and external dimensions. Based on a qualitative study through eight expert interviews, it examines those three dimensions and how they affect sustainability and global trade dynamics. The results show that AI offers clear benefits in forecasting, efficiency, and emissions reduction, but only when certain factors are met.

This study bridges the gap between theory and practice by providing firms with insights to enhance supply chain resilience and competitiveness in an increasingly digital and sustainable global world.

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Keywords

Artificial Intelligence, Supply Chain Management, Global Trade, Sustainability, Digital Transformation

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1 Introduction

AI is no longer a concept of the distant future. It's already changing how companies work, especially within Supply Chain Management. From predicting demand to helping with logistics, AI is a part of everyday business in most industries. A recent McKinsey report showed that one in three companies now uses AI in at least one core area (Chui et al., 2023). Another study found that firms using AI in their supply chains cut logistics costs by 15% and improved inventory levels by over 30% (Cohen & Tang, 2024). AI doesn't just speed things up, it also assists human decision-making. This can be seen as a full circle moment since the AI technologies that are currently employed stem from mimicking human reasoning. Therefore, it can help supply chain managers and other players in the sector make better decisions. (Menache et al., 2025). Despite all this progress, there's still a lot we don't fully understand. Why do some companies succeed with AI while others struggle? What makes adoption easier, and what gets in the way? And what does all this mean for sustainability and global trade? This work project aims to respond to those questions. It focuses on how companies use AI in supply chains, what helps or blocks adoption and how the impact looks on all the mentioned levels. To find out, this thesis reviews the latest research and then compares and analyses it to voices from the industry, speaking with eight experts. Their insights help connect theory with real life and offer a clearer picture of where AI is taking us next in the context of Supply Chain Management.

2 Literature Review

2.1 Definition of Artificial Intelligence

The following sections will examine what the literature says about AI, its features, and how it can be applied to SCM under the Implications of Sustainability and Global Trade. The ability to perform cognitive functions usually carried out by humans or require human intelligence is defined as AI (Dobrev, 2004). These tasks include learning from experience (Machine

Learning), understanding language (Natural Language Processing) and recognizing patterns. It can be spoken of AI when machines are designed to think, learn and make human-like decisions (McKinsey & Company, 2024). This is all done with a certain degree of autonomy (Chui et al., 2023). At the World Economic Forum in Davos, Sam Altman (2024), CEO of Open AI, stated that AI promises to enhance productivity, ease decision making and improve repetitive tasks by automation. While the initial concept of AI was coined by John McCarthy in 1956, Alan Turing brought up the concept of the Turing Test a few years earlier. Here, a human interrogator would have to differentiate between a human and computer text response (Kremer, 2024). AI has seen many stages of development and evolved substantially from where the first definition started (AI HLEG, 2019).

2.2 Core Concepts

Many areas of AI focus on certain aspects of intelligent systems (Stryker, 2024). Most researchers tend to primarily focus on generative AI developments (Stryker, 2024). To really understand AI, one needs to understand on what technologies and tools it is based on.

In machine learning, algorithms are trained to classify new data or make predictions based on data-this process is called supervised learning (Stryker, 2024). Unsupervised learning, or deep learning, works through neural networks that imitate human decision-making suited well for natural language processing (Stryker, 2024). Through NLP, a computer is enabled to understand and synthesize human language via Linguistics, Computer Science, and Machine Learning (Chowdhary, 2020). It handles translation, summarization, and sentiment detection, thereby acting as a bridge between human and machines.

Computer Vision is a branch of AI that uses algorithms to find patterns within images with very minimal human intervention (Karn, 2022). It converts images into numerical data through convolutional neural networks (NVIDIA, 2025) and then uses this data for recognition and identification tasks (AWS, n.d.).

Generative AI is an umbrella term for computer technologies that generate textual, visual, or audio content (Feuerriegel et al., 2023). Goldman Sachs (2024) estimates that Gen-AI technologies will help raise the worldwide GDP by almost 7%. Gen AI usually follows three phases: training, fine-tuning, and generation of content (Feuerriegel et al., 2023). DALL-E 2, GPT-4, and Copilot are a few incarnations that are reshaping how we interact with and exchange information.

2.3 Key Applications of Artificial Intelligence in Supply Chain Management

Recent studies have consistently focused on the inclusion of AI into the Supply Chain. The research highlighted the positive effect of AI on supply chain operations and has proven to be an excellent assistant in improving operational efficiency, strategic innovation and sustainability (Samuels et al., 2024). AI has become a big help in making the supply chain and organizations more agile, flexible, and resilient, particularly under disruptive events such as the COVID-19 pandemic (Siagian et al., 2021). Predictive analysis powered by AI to optimize supply chains is an enabler for improving operational efficiency, reducing costs, and increasing customer satisfaction (Nzeako, 2024). Therefore, a precise prognosis and prediction for anticipating demands can be done, leading to an improved planning process. The previously explained concept of machine learning often supports this application. Production quality and cost reduction can be achieved by optimizing processes that AI analyses (Dash et al., 2019). Optimization does not only happen in R&D, but also in warehouses and logistics (Louis Eyo-Udo, 2024). Louis Eyo-Udo (2024) states that by utilizing AI in SCM, future demands for warehouses can be predicted with high accuracy, which enables businesses to optimize inventory and prevent over- or understock. AI also enables the automation of recurring tasks in Supply Chain Management, which leads to enhanced efficiency (Smyth et al., 2024). Hendriksen (2023) also states that automating tasks can reduce manual errors, leading to increased operational efficiency. Pournader et al. (2021) state that AI can not only help to

alleviate risk, but also enhance Supply Chain Visibility, which helps risk management pre-predict disruptions in the Supply Chain (Pournader et al., 2021). A step-in advance, AI can help SCM in supplier selection and their management (Singh et al., 2020). This is a critical aspect for SCM since the right choice of suppliers is directly interlinked with the quality, cost and reliability of Supply Chains (Singh et al., 2020). Regarding predictive maintenance, AI can predict possible outages or breakdowns in production units, where multiple machinery work together. (Dash et al., 2019). By gaining insights on this, the process in machinery can be set up more robustly and preventive maintenance can be done, due to the predictive maintenance that the AI enables, through collaborative robots that facilitate the processes. (Dash et al., 2019). Energy provider companies use predictive maintenance by maintaining data, sensors and other hardware to help machine learning applications avoid decommissioning and closure of systems before their useful life. This guarantees more frequent remote inspections to ensure plant functionality (Dash et al., 2019). According to Smyth et al. (2024), Generative AI has a massive potential for designing and optimizing Supply chain Networks. This entails coordination of logistics, transport and distribution (Smyth et al., 2024). Recently, the concept of Green SCM has risen to popularity, which connects environmental considerations to SCM Practices (Samuels, 2025). AI is able to analyze environmental data and therefore improve energy efficiency and reduction of carbon emissions (Samuels, 2025).

2.4 Role of Artificial Intelligence in Global Trade and Sustainability

2.4.1 Artificial Intelligence in Global Trade

In this section, the literature about the topic of AI in Global Trade and Sustainability will be examined. International trade and sustainability are being redesigned by AI in an age when globalization and environmental care are gaining more speed (Thomas, 2024). AI creates efficient international trade by streamlining customs processes, optimizing logistics, and providing real-time data and insights to attenuate disruptions in complex supply chains.

Automation minimizes costs and human error, making logistics and customs procedures more effective across borders (Achar, 2019). However, the AI could also be moderated in its impact through trade policies, tariffs, and standards that determine the access and costs of such essential technologies. All in all, AI makes up for yet another catalyst where global trade is becoming more efficient, resilient, and competitive (Okonjo-Iweala, 2024). Digital platforms have revolutionized the way small businesses operate globally. A striking example is eBay, where 97% of small enterprises engage in exporting, a stark contrast to the 4% of traditional offline businesses (Achar, 2019). The introduction of advanced translation services, powered by AI, has significantly boosted cross-border commerce (Wang et al., 2018). Other companies use smart manufacturing by implementing IoT sensors to connect customers, machines, suppliers and systems (Meltzer, 2018). This can expand the global value chain by enabling specialised service providers in areas such as research and development, design, robotics and data analysis (Meltzer, 2018). Trade policy decision makers react to AI as one of the most disruptive technologies (Jones, 2023). Current trade rules possess significant shortcomings to foster effective AI governance and need updates (Jones, 2023). Last updated digital trade rules impose stricter measures on intellectual property from both the source codes and algorithms (Jones, 2023). Tariffs can increase prices and create challenges for adopting AI, particularly in countries without domestic alternatives to imported technology. AI hardware is highly specialized and often more expensive than standard computer equipment due to its advanced components (Achar, 2019). Even small tariffs can raise the cost of information and communication technology (ICT) equipment required for AI applications. These elevated tariffs hinder businesses from adopting AI tools and limit opportunities for these nations to build their own AI expertise (Achar, 2019). Such barriers could undermine efforts to use AI for development goals, including supporting developing countries in addressing challenges like pandemics (Achar, 2019).

2.4.2 Artificial Intelligence in Sustainability

Global demands and external pressures, like regulations, force companies to become more sustainable in their business processes. AI is emerging as one of the transformation tools in this (Divya et al., 2024). Practices that minimize environmental harm, and promote social responsibility, while ensuring the business and economic viability isn't lost in the process, are becoming a top priority to navigate for global players (Divya et al., 2024). AI, with its ability to analyze extensive datasets, identify patterns, and render informed recommendations, presents an unparalleled potential to address these requirements (Divy et al., 2024).

Real-world examples of the role of AI in sustainability include, for example, the monitoring of real-time energy usage (Uriarte-Gallastegi et al., 2024). This helps identify inefficiencies on the spot. Businesses can improve their environmental footprint by improving the processes while minimizing costs (Uriarte-Gallastegi et al., 2024). The convergence of IoT devices and AI enhances sustainability efforts by enabling real-time monitoring of environmental conditions and resource usage. This combination often provides the data necessary for effective decision-making (Uriarte-Gallastegi et al., 2024). Also, AI extensively aids the transition toward a circular economy and closed-loop material cycles whereby products and materials are reused, refurbished, or recycled (Thomas, 2024). It optimizes the life cycle of products and reverse logistics involved in waste management and resource recovery. Not just that, but by using waste sorting systems, easy identification and recovery of valuable materials is possible. This enables a transition toward circularity (Thomas, 2024). It also identifies potential areas of energy consumption inefficiency and refines energy-efficient operation of the production facilities in general (Divya et al., 2024). The work performed here helps diminish waste, emissions, and needless energy usage in line with sustainability objectives. Nevertheless, AI is indeed subject to implementation barriers, including poor data quality, lack of technical knowledge, and ethics, all of which need addressing on an equal footing (Divya et al., 2024).

2.5 Challenges and Opportunities for Artificial Intelligence Adoption in Supply Chains

AI powered SCM is changing how global networks do business, allowing efficiency, resilience and sustainability which were previously hard to achieve (Goswami et al., 2024). Nevertheless, multidimensional challenges such as data quality, infrastructure issues, and ethics are a topic (Goswami et al., 2024). A transparent and automated supply chain will help with that. This section reviews and investigates both the barriers and potential of AI adoption within supply chains, emphasizing its implications for sustainable development and global trade.

Data-related challenges for integrating AI in supply chains are seen as one of the biggest factors potentially preventing successful AI transformations for supply chain managers (Goswami et al., 2024). A big barrier to a good integration process is data quality and availability (Fosso Wamba et al., 2023). This is especially difficult, since in supply chains the data can be fragmented, inconsistent and difficult to access, which therefore limits accuracy and effectiveness when utilizing Generative AI models for example (Fosso Wamba et al., 2023). Also, adding to the data quality factor, it is important to note that technical limitations might make the largest data set irrelevant if not carefully organized (Hangl et al., 2022). That's why data analysis must be undertaken with the right tools and analyzed with the correct and capable technology (Hangl et al., 2022). The lack of competence and understanding and willingness to accept new ideas is a barrier to applying and integrating AI in SCM (Hangl et al., 2022). Also, issues such as internet scalability, the heterogeneity of data and computation efficiency might threaten AI integration in supply chains as explained in an earlier study by Ben-Daya (2019). Other barriers are the lack of transparency, security concerns, privacy issues and missing technology standards. All of these need to be robust, which imposes an additional challenge (Hangl et al., 2022). The factor of change management and the human side that is added to the technology side of AI is also one of the main barriers (Hangl et al., 2022).

The implications for sustainability can be classed into different categories. Direct contributions

are reduction of emissions and waste as well as resource optimization through AI integration (Fosso Wamba et al., 2023). Indirect contributions are especially the enhancement of the circular economy through traceability of so-called reverse logistics that include demanufacturing and recycling (Merkert et al., 2023). Also, AI technologies like Generative AI is able to summarize performances of suppliers, and help with suggesting procurement actions, which has the automation of tasks as a consequence. This increases the velocity of supply chains, improves forecasts, and helps make the right decisions (Oca et al., 2025). Additionally, AI can enhance End-to-End Supply Chain visibility (David, 2025). By analyzing data, it can find root causes for problems and help SCM Managers make adjusted decisions (David, 2025). Another factor is the tackling of labor and skill shortages, so Amar et al., (2024), who state that through AI demands can be planned better so shifts are scheduled in a more efficient way. Narrow rollouts of AI use cases seem to have ROI within weeks by tracking real-time data. This builds trust in the workforce (Amar et al., 2024).

3 Methodology

This thesis adopted a qualitative research methodology to explore and answer two pivotal research questions (RQ):

RQ1: What challenges and enablers shape the adoption of AI in SCM across organizational, technological, and external dimensions?

RQ2: What are the implications of AI integration in SCM for sustainability and international trade dynamics?

The primary data for this study were collected through a series of eight semi-structured interviews with industry experts, detailed in the Appendix. These interviews provided valuable insights and direct perspectives, contributing significantly to the primary research data. An academic literature review was conducted alongside these interviews, ensuring a robust and well-rounded understanding of the topic. The choice of qualitative methods aligned well with

the exploratory nature of this research, particularly given the recent emergence of AI in the industry.

3.1 Sampling Strategy and Selection of Interview Experts

Initially, 45 potential participants were contacted via private network and also LinkedIn. They received an overview of the study. Ultimately, 8 experts agreed to be interviewed. The selection of participants in this study was based on the role of individuals in the supply chain and thereby ensured a very diverse representation of professionals involved in AI integration and sustainability efforts.

Another selection criterion hinged on expertise in AI-driven supply chain technologies. The participants had experience working with predictive analytics and automation, as well as machine learning applications for demand forecasting and AI-powered logistics optimization. The experiences held by the participants were related to examining AI adoption effects in the supply chain setup. Sustainability was also considered as another qualification. Selected participants had broad knowledge of sustainable supply chain practices relating to carbon footprint reduction, ethical sourcing, circular economy strategies, and regulatory compliance across global trade. Their views cross-examined AI-derived efficiencies against sustainability goals. The goal of these requirements was to guarantee that the participants were qualified in terms of their familiarity with the research topic and its goals. A variety of views and viewpoints were collected by selecting individuals with a range of jobs, experiences, and project types. The sampling strategy's overall goal was to offer a wide variety of perspectives and experiences on the application of AI in SCM.

3.2 Interview Procedure

The interviews were held in a remote setting via secure video conferencing. Each session lasted

between 20–40 minutes and was guided by the semi-structured interview guide covering critical topics while giving participants freedom to expand in areas they considered most important and relevant. This provided a suitable balance between consistency and flexibility, allowing for the in-depth exploration of key issues and areas.

4 Execution of Findings

4.1 Management of Data and Ethical Considerations

Before each interview, participants received an interview guide specifying the purpose of the study, confidentiality measures, and ethical standards. Informed consent was obtained, and the right to withdraw was granted at any time. Interviews were recorded with consent and automatically transcribed via Microsoft Teams. The data were kept under secure storage, and this study adhered to institutional ethical guidelines and data protection laws.

4.2 Data Analysis Procedure

The qualitative data were analyzed in this study, by using a clearly defined approach – scientifical thematic content analysis. Expert interviews were transcribed and coded according to a category system developed inductively from the material while also being aligned to the general research questions. First, open coding was conducted in the inductive fashion to allow for the emergence of patterns, themes, and concepts important to the participants in this research. These inductive codes were then clustered and put into higher-level analytical categories to represent all the organizational, technological, and external dimensions as well as implications for sustainability, international trade, and future-oriented best practices. Any code was linked to one of two central research questions to ensure analytical clarity and traceability. The coding was manually done by the researcher. Hence, the consistent nature of the codes throughout the interviews. This resulted in the creation of the coding tables, which can be found in the appendices. These Coding Tables enabled comparison and derivation of empirical insights that feed directly into the study's key arguments. Hence, making the process

transparent, replicable, and, most importantly, theoretically saturated across the different stakeholders' views. That's why there are limitations with this mode of data analysis due to researcher subjectivity bias or preconceived conception which makes the researcher likely to miss out on some of the significant parts of the generated data.

5 Findings

5.1 Technological Dimension

The integration of AI within the supply chain remains highly dependent on a variety of technical enablers. Four main subthemes were elicited from the interviews under this dimension: data management, AI as an enabler, system readiness, and complexity of digital architecture. While the participants agreed on the theoretical capacity of AI to streamline operations, their experiences brought to the forefront the infrastructural gaps and systemic gaps that still needed to be addressed before transformation can begin. Experts were in an absolute agreement on the notion that poor data quality, siloed architectures, and inconsistent formats were the chief culprits behind disastrous or below-par AI implementations. As Astrid Rothaut (Brunata) remarked, "Only when the data is clean—not duplicated, not ambiguous, clearly categorized—can you truly achieve impressive results with AI." Her reasoning was echoed by Michael Kranz who stated that AI depends entirely on upstream process design: "If the process is not properly set up, you end up with poor-quality data". Werner Schwarz noted that while his organization had comprehensive datasets—from sales history to weather trends—the lesson was clear: "The AI model only performs as well as the data it has access to". Interviewees shared numerous practical applications already in use, particularly in forecasting and early-stage automation. Sikko Zoer described early-stage automation at Medtronic: "We implemented automated invoicing using optical recognition systems, and there was some light machine learning behind it". Similarly, Jan Behnke highlighted: "We currently use AI in the area of incoming invoice scanning and in the incoming document process in general". These examples demonstrate that

AI's value lies in measurable improvements—particularly in standardized, data-heavy workflows. Astrid Rothaut stressed the importance of disregarding extreme hype cycles, noting: "Most of these things already existed. Today's AI is simply the next level—an additional layer of automation and algorithms". Michael Kranz explained, "Even basic machine learning algorithms can qualify as a kind of AI —and you can already achieve quite a lot with them". Many companies, despite ambitions, are still constrained by outdated infrastructures and scattered data landscapes. Anonymous B noted, "You need data. Very good quality data. And until recently, there wasn't a strong enough need to have the highest accuracy of master data… there are still quite a few silos". Anonymous A expressed similar frustration: "In the projects we've worked on, we've mostly seen that many of them fail due to poor master data quality". As Anonymous A explained, while concepts like digital twins are gaining traction, the foundational efforts are still missing: "First, companies need to clear the table so that their IT organization is cleanly structured. Then you can build digital representations of the supply chain". AI is not a tool that can be immediately inserted and applied, it requires an entire rethink of data and systems interaction. In summary, while much enthusiasm surrounds AI, the technological foundation still remains patchy. It was revealed by the interviews that the larger share of advancement depends less on complex algorithms but more on infrastructural maturity and data stewardship and on the integration of new tools into existing legacy environments. As Werner Schwarz puts it, AI will not show up through a big break but with a steady series of small steps: "Start low-threshold, achieve results quickly… then turn it into a classic project".

5.2 Organizational Dimension

While technological infrastructure lays the foundation for AI integration, the success or failure of such initiatives is often determined by the organizational culture, mindset, and internal alignment. Across all interviews, a consistent pattern emerged: organizations are still struggling

with resistance and acceptance problems, lack of digital readiness, and internal silos that hinder the operationalization of AI. The inductive codes that were analyzed from this category reflect a combination of skepticism, legacy thinking, and the human factor, all issues that technology alone cannot resolve. A central theme was the reluctance to trust AI outputs. Several interviewees described how decision-makers hesitate to rely on systems they do not fully understand. Michael Kranz expressed it very clearly: “One of the biggest challenges is building trust in the results that an algorithm or AI delivers”. He observed that many professionals still operate under the mindset of “I don’t trust anyone to do something in Excel that I can’t recreate myself”. Closely linked to trust is the fear of loss of control or relevance, especially among long-standing employees. Astrid Rothaut noted: “There’s a lot of resistance in Europe. Concerns about privacy, personal job security, and simply a fear of the unknown”. Sikko Zoer added that individuals who deal with data governance or transformation are often overlooked internally, despite playing a crucial role: “Nobody likes data management, it’s not sexy. The people responsible are hidden away somewhere, not taken seriously.” In many companies, these cultural barriers are adding up creating a lack of clarity around AI’s value proposition. Anonymous B captured this tension in practical terms: “Technology is there, but to make it work sustainably inside a company, it requires a systemic change—not just, you know, putting lipstick on a pig”. Another challenge is around ownership of data and silos in which organizations operate. Jan Behnke pointed out that relevant information has largely remained locked in individual know-how or dispersed systems: “The biggest challenge for companies is to first make the knowledge transparent, be it in heads, DMS systems, or ERP”. As Anonymous A added, even within large organizations, “many are still working with Excel files or CSVs, shared somewhere in the depths of a server”. There Sikko Zoer placed great emphasis on the need for cross-functional awareness: “People always focus so much on the technology... but to really build something sustainable and successful, it takes more”. Digital innovation is not a

purely technical project but a change management—the major component being communication trainings and executive sponsorship needed for successful transformations. Finally, the conservative structural constraint in skill gaps has to be addressed, as Anonymous B noted that in large organizations, “it’s even a skill issue just to work with data, not even thinking about doing complex simulations in supply chain". In sum, the technological pathways to AI are swiftly developing, while companies have all the more still to come up, having their structures, cultures, and internal dynamics restricting progress. To be successful and put AI tools to use, organizations need to move away from project-oriented thinking toward the design of such approaches as making change commonplace; democratizing data literacy and embedding digital trust at all levels.

5.3 External Dimension

Beyond the existing internal barriers, the integration of AI into supply chains is also significantly shaped by external forces, particularly regulatory uncertainty, data protection frameworks, and ethical constraints. Participants in interviews acknowledged how forces of this sort tend to cause hesitation, confusion, or even paralysis in the organizations. The evolution of the regulatory landscape, especially in Europe, now leaves organizations walking a thin line between innovation and compliance. The most commonly cited concern was the uncertainty created by regulation, especially in anticipation of the EU AI Act. Werner Schwarz recalled the impact of early drafts: “The version that was ultimately adopted still has 180 pages. That alone creates a huge amount of uncertainty. Even companies like ours, application-oriented companies, now have to ask: What are we required to do? What are we allowed to do?”. This makes things more vague for smaller and mid-sized firms that lack in-house legal capacity to interpret newer frameworks. Michael Kranz added a strategic layer to this concern, arguing that some AI applications may intersect with critical infrastructure: “Supply chains can also be

considered part of critical infrastructure... the regulation becomes relevant". For sectors involved in areas like energy, defense, or pharmaceuticals, this reclassification carries significant consequences. Data protection and cybersecurity also emerged as concerns. Anonymous B (Merck Group) pointed out rising cyber risks: "Cyber security threats are also a challenge when really going all-in, because once you automate and connect everything via the internet, cyber threats become an issue". Andreas Pfau addressed the tension between transparency and privacy, especially when discussing supplier data: "From the stakeholder perspective, it becomes interesting when I need data from companies that are not my own... The obstacles are definitely data availability and data security, both from the perspective of those who want to use the data and those who have to provide it". Andreas raised a critical question about fairness in data-driven supply chains: "Suppliers who provide more data might automatically perform better or get better treatment, while others—who may be more reserved—could be disadvantaged". These dynamics could unintentionally penalize smaller players or suppliers in jurisdictions with stricter data laws, ultimately exacerbating inequality in global trade. Another recurring narrative was the contrast between Europe and other global regions, especially when it comes to handling innovation and regulation. Many experts noted that EU tends to take a "regulate first, innovate later" approach, in contrast to the US and parts of Asia where innovation is prioritized. Jan Behnke put it simple terms: "That's still a pretty big issue at the moment, regulating first and then developing something. And of course, that's incredibly difficult". Anonymous B further pointed out that although innovation is very strong in Europe, expanding it across fragmented regulatory landscapes is a big problem: "I don't think we lack innovation in Europe. We do innovate. But I think we are terrible at scaling". Concluding the external dimension findings, regulation seems to be necessary, according to the experts. Though, the current way of regulating often slows down progress. The challenge for European companies lies in navigating this paradox while maintaining global competitiveness.

As this dynamic continues to take shape, the success companies will have depends on their compliance and strategic agility.

5.4 Sustainability Implications

Throughout all the expert interviews, the consensus was that AI can be a powerful sustainability driver. This through efficiency gains, waste reduction, and optimized decision-making. The voices from varying industries emphasized that sustainability and AI are not opposing forces but mutually reinforcing. In fact, several experts described environmental improvements as a byproduct of well-executed AI strategies that will come naturally, if done correct. Werner Schwarz quoted it word for word: “Whenever I gain efficiency in a supply chain, whenever I avoid waste, I’m also making a contribution to sustainability”. This view was echoed by Anonymous B, who brought up the operational benefits of scenario planning in transport logistics: “You can also use this to fine-tune your supply chain for sustainability... that’s the most sustainable way, instead of using a dedicated airplane”. She described how AI-supported planning systems allow companies to shift transportation modes and prioritize lower-emission options when time allows, thereby aligning cost-efficiency with climate goals. Andreas Pfau framed sustainability not as an isolated corporate responsibility, but as an outcome of smarter resource allocation: “Wherever we act more efficiently, develop businesses more effectively, use less energy, and produce less waste, things become more sustainable”. This logic was then reinforced by Anonymous A, who emphasized that sustainability is not always a deliberate target, but often follows naturally from the optimization of data-driven processes. Sikko Zoer described how AI can create greater transparency in supply chains, allowing companies to avoid panic-driven overordering or reactive logistics measures: “AI can make your supply chain network more visible and transparent... every inefficiency in a process typically leads to higher costs, unnecessary urgency, or even panic responses”. The value of the predictive capabilities

was another point further stressed by Michael Kranz who noted that AI can enhance the route planning and utilization in transport logistics: “AI could help here by ensuring better capacity utilization or more efficient route planning, which would already be a contribution to sustainability”. Interviewees also recognized a few limitations. The real outcome will depend on how companies act it out, they said. In conclusion, the interviews speak about AI being a quiet force for sustainability, not through grand declarations, but through smarter, leaner, and more responsive systems. The more transparent and optimized a supply chain becomes, the more it supports the environmental goals naturally. With expanding AI and maturity, it could also act as a bridge to join operational performance with sustainability agendas.

5.5 International Trade Implications

The integration of AI into supply chains is not only reshaping internal operations but also redrawing the contours of international trade. Across the interviews, experts voiced both enthusiasm and concern about how AI could alter competitiveness, supplier dynamics, and geopolitical dependencies. At the heart of these reflections was a common belief: the future of trade will depend on who can translate data into action the fastest, and with the most agility. A dominant theme was the idea of AI accelerating global competition. Sikko Zoer offered a prediction: “What I see, and not just with AI, but in general, is that Europe is significantly behind. I expect that power will shift even more toward the U.S. and China”. His view was echoed by Anonymous B, who noted that while Europe is home to a lot of innovation it often fails to grow: “We do innovate. But I think we are terrible at scaling”. Some have voiced worries that AI could intensify the divisions between digitally advanced and less digitally ready regions. This is one issue that Andreas Pfau mentioned: that models like social scoring in Asia are representative of where some nations are willing to go: “You can see what can be achieved without ethical boundaries, also in relation to supply chains”. Another key discussion was

centered around the shifting paradigms of sourcing and trade flows. With automation and AI reducing the cost advantages borne by low-wage regions, companies are rethinking their global footprints. Anonymous B pointed out: “Now, with globalization reversing, with added tariffs and all, it might be that some companies will move back into more so-called near-shoring. But then, they’ll invest more in automation and AI”. Interviewees discussed the potential for AI to bring transparency into complex and multi-tiered supply chains. Andreas Pfau envisioned a world where agent-based AI systems manage the entire procurement processes across borders: “What we’ve known as ‘traditional trade,’ in my view, will increasingly require transparency, AI and agent-based AI will, in my view, fundamentally revolutionize that space”. These intelligent systems could assess the supplier risk, monitor compliance, and dynamically reallocate sourcing based on real-time constraints. Anonymous A also emphasized the long-term strategic impact: “I believe we’ll see strong market consolidation... as systems become better integrated and automated, everything will become leaner and faster”. Jan Behnke stated: “It should help the companies themselves to be able to deliver more quickly... and recognize future requirements based on historical data”. In a context where agility may be more relevant than geography, this represents a profound change in how international value chains are organized. In summary, AI is both a disruptor and an accelerator in international trade. From supply visibility to risk forecasting and process automation, its influence touches all points of the global supply web. Whether this can lead to greater inclusivity or a concentration of power depends largely on how companies and countries respond, with investment, governance, and a strategic view of data as a global currency.

5.6 Best Practices & Future Prospects

While there are still many challenges and uncertainties, the experts interviewed also shared a set of concrete insights and forward-looking strategies for the correct implementation of AI into

supply chains. A recurring best practice was to begin with low-risk high-impact use cases. Werner Schwarz emphasized the effectiveness of this approach: “Start low threshold, achieve results quickly. I think that’s a great approach, especially in digitalization projects: start fast, don’t be afraid to fail fast. And if results are positive, then turn it into a classic project.” Similarly, Sikko Zoer summarized his formula for progress: “Start small, think big, scale fast”. Anonymous A noted that early-stage AI projects often succeed or fail based on alignment: “That’s why what we often start with workshops. What’s important to you? What do you actually want to achieve? That’s the most critical part”. For Jan Behnke, the value of AI is clearest when it targets well-defined operational challenges: “We currently use AI in the area of incoming invoice scanning and in the incoming document process in general. It’s tangible, understandable, and also easier to ‘sell’ to our customers”. Anonymous B advocated that for a smarter allocation of resources: “If you want to invest 5 million in AI, maybe spend 2 million on actually applying the technology, and 3 million on streamlining your processes… Not just putting all 5 million into AI”. Andreas Pfau pointed at the rise of agent-based AI systems that could automate the entire procurement decisions: “Promising success always comes from starting small and thinking big. Don’t aim for the giant leap from the beginning. Take small steps to approach the bigger picture gradually”. Anonymous B raised concerns about scaling AI responsibly: “If you add the challenges around it, it’s also the skills of people in the organization. It’s even a skill issue just to work with data”. In conclusion, the best practices shared across all interviews reflect a very pragmatic but optimistic outlook. Looking ahead, the organizations that master the art of scaling from the ground up, without losing sight of human needs and ethical boundaries, are most likely to shape the next chapter of intelligent supply chains.

6 Discussion

This section critically evaluates and analyzes the findings from this study comparing it to the literature review that was conducted for this work project. The goal is to reflect critically on how AI can shape SCM across different dimensions that are derived from the research questions. Each dimension that was looked at in the findings will be analyzed and discussed, concluding the intertwinements between theory from the literature and practice from the expert interviews.

The key themes for the technological dimension were data quality, system readiness and AI as an enabler. The majority of our experts and parts of the literature are in accordance when saying that siloed data is the biggest block for AI integration. Most state that nice, clean data is preferred to the fancy algorithms that the literature describes. This shows that in this area the industry seems to be still quite behind in contrast to what is possible. Confirming that, our experts tell that legacy systems like the "good old ERP" are still dominating. The literature assumes digital twin models to help integration. This underlines that SCM is not quite there yet. It can be said that rather than cutting edge AI models, companies need solid data governance to ensure successful AI integration. This goes against what the literature stated, where it was said that machine learning algorithms can overcome noisy inputs by learning robust patterns. This doesn't seem to be very accurate in practice, since the aforementioned solid data governance is crucial. Taken together all of this, the findings underline that these factors are necessary and need to precede any AI model deployment for companies to see an added value effect that is consistent.

On the organizational level, human factors are presented to be the greatest hurdle for integration. Citations like "If I can't rebuild it in Excel, I don't trust it, confirms the literature that human skepticism stalls AI. The factor of human competency in using AI comes into play

as literature argues for dedicated data literacy programs. This goes to show that in practice we are quite close to the theory. Yet, experts stated that explainable dashboards feel like black boxes to professionals, which suggests that the human side of it, is still very adhesive to the integration of AI. This goes against the literature that signals explainable AI tools to be the cure for user skepticism. Apparently, the integration has still got a long way to go on the organizational side of things.

These insights stress that AI integration must be treated as a transformation rather than a one-time big deployment. Through external factors the regulatory uncertainty especially in the EU leave many hesitant as the literature confirms with the experts. The regulate first motto can slow innovation, which we hear from voices out of the industry. It's safe to say that a competitiveness gap will be created because of that dynamic. Hence, companies must remain flexible in order to keep innovation alive, even under strict rules. This means that smaller suppliers could be at a disadvantage because of the strictness. It is recognizable that the EU is moving more cautious which makes things slower compared to other parts of the globe, like in the US or in Asia. Another factor for fearing AI integration are privacy concerns that smaller scaled suppliers mentioned in the interviews. This goes against the literature, that stated that platform based ecosystems boost data exchange automatically. This goes to show that successful ecosystems with many different external factors need clear legal guidelines that foster open data exchange. Which in hindsight enables better AI integration.

When examining the sustainability implications, it is clear that the experts align with the literature in the sense that AI can optimize routes for logistics, which entails sustainability through efficiency. The demand forecasting that can be improved by integrating AI can not only cut costs, but also unnecessary emissions. Some that might have never been thought to be reduced. The underlying thing that can be taken from this point is that AI might be able to

suggest sustainable drivers and steps, but it cannot integrate it directly. It is necessary that the measures that need to be taken are summarized in the right KPI's. Hence, if done correctly AI integration can make SCM more lean and greener. To achieve that long term, targets that include waste and emission reduction need to be incentivized.

The main points of the global trade implications start with the rethinking of geography. With the automation that is possible through AI integration, near shore capabilities crystalize. This mainly because the off shorings low wage advantages become lesser by replacing human labor with AI. This builds on what the literature states about end-to-end visibility. The Agent based AI can reroute and re source multiple suppliers more transparently than poorly trained humans. The trade powerhouses of tomorrow will most likely be the ones to control and get the best out of the most powerful AI tools and applications. This will not only make existing trading faster but could redraw some of the global value chains. These now being drawn around data agility rather than low labor costs, showcasing the huge advantages that AI integration could enable. What the literature states, which the experts didn't pick up on is the nowadays ever-growing volatility of global trade due to tariffs. The literature states that even the smallest tariffs can have massive impacts on trade dynamics. Hence, a good overall forecasting and great flexibility are essential to leverage AI for more robust global trade.

7 Conclusion

The research in this work project was done to examine the topic of integration of AI in SCM and the implications it has for Sustainability and Global Trade. The two research questions were set up to explore which technological, organizational and external factors shape AI. In addition, it was explored how AI integration affects sustainability and global trade.

The work project shows that the true value in AI for SCM isn't in flashy algorithms but rather in clean data, flexible systems and human trust. While currently messy systems and data still

hold firms in the industry back, it can be ensured that AI is able to reduce waste and speed up global trade when integrated with care in SCM. Regarding the sustainability the most common finding was the fact that efficiency often equals sustainability. Here AI improves routing and forecasting, simplifying the management of supply chains. Since most companies don't track these KPI's the benefits often occur unnoticed.

Turning to Global Trade, data agility seems to become the new main edge, as it enables supply chain managers to respond fast to unforeseen changes. That is why the firms with the best data and not just the cheapest labor are set out to dominate the future.

However, several challenges remain. Tariffs and regulations can vary rapidly emerge, which might limit the AI integration impact.

Based on these results, there are plenty of recommendations for industry practitioners. The two main ones that sum it all up highly accurate are the following. Firstly, starting bottom up and setting up a data excellence center / teams so the foundation for successful utilization of AI can be ensured. This entails being able to work on top of accurate and accessible information. Secondly, gaining human trust in the entire process, running projects that are short in the rollout phase, but have a high positive impact. This means having one or two specific goals like "25% reduction of carbon emission in supply line A". Conducting it in that fashion can ensure that entire organizations become more in tune with AI integrations and don't get overwhelmed by the magnitude of it due to the sheer size of capabilities that AI possesses.

Ultimately, Supply Chain Managers that adapt to these recommendations will be able to unlock the full potential of AI integration, creating a resilient, sustainable and globally competitive supply chain management.

7.1 Limitations, Future Research & Outlook

The collection and analysis of the data could include biases. For instance, the interview questions may unintentionally steer participants towards particular responses or leave out

crucial details of the subject. Also, researcher bias in thematic coding needs to be accounted for. Additionally, because the experts geographic background is concentrated mainly on the European region and industry sector, there may be restrictions on how broadly the findings may be applied. It's possible that the findings won't apply to other regions or sectors. As this study is qualitative in nature, the findings aim for contextual insight rather than broad generalizability. Transferability is limited to settings with similar industrial and regional conditions. Also, because of the interview partners varying in their role, there is some inconsistency in the coding of the findings, due to the openness of the questions, which implies a lot of varying answers, making it harder to conclude categoric and structured findings. The nature of semi structured interviews also doesn't allow statistical quantification of any results, which needs to be accounted for when looking at these results. The rapid advancements and changes in AI tools and regulations means that some of the insights that were stated here might evolve quickly. This might lessen the results in this work project. Another factor that limited this work project were interviews that fell through because of availability difficulties due to sickness and / or struggles for companies during these economically challenging times. Experts in leading roles from global companies like Volvo had to reschedule which led to time running out to include their findings. Bankruptcy for a non-disclosed AI start up made it impossible for an expert on AI and machine learning to participate in an interview.

For Future research it is advisable to survey a larger sample that is more geographically diverse. That would entail relevant regions like the US, LATAM, Asia and Africa. This leads to the ability to identify even more accurate barriers or enablers on a more global scale. It could also be beneficial to combine qualitative with quantitative research. This enables so called data triangulation, making results even more precise. Hence, helping us gain a deeper insight into how AI integration in SCM can be conducted and its implications on Sustainability and Global Trade.

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Note: AI tools such as NotebookLM (Google, 2023) and ChatGPT (OpenAI, 2023) were used to support background research, idea generation, and thematic structuring. All critical thinking, interpretation, and final writing were conducted by the author.

9 Appendix

9.1 Abbreviations

Abbreviation	
AI	AI
SCM	Supply Chain Management
ERP	Enterprise Resource Planning
NLP	Natural Language Processing
ML	Machine Learning
RPA	Robotic Process Automation

Abbreviation

LLM	Large Language Model
D365	Dynamics 365 (Microsoft ERP system)
KPI	Key Performance Indicator
IoT	Internet of Things
DMS	Document Management System
SOP	Standard Operating Procedure
EU AI Act	European Union AI Act
Bl	Business Intelligence
HLEG	High-Level Expert Group (on AI, European Commission)
GDP	Gross Domestic Product
IT	Information Technology
BCG	Boston Consulting Group
SME	Small and Medium-sized Enterprises
KPI	Key Performance Indicator
GEN AI	Generative Artificial Intelligence

9.2 Interview Guide

- Welcome and introduction of the interviewees
- Explanation of the purpose of the interview

Background Information		1. Can you give us a brief overview of your professional career, especially with regard to your previous experience with AI in supply chains? 2. What industry and company size do you work in and what is your current role in your organization?
RQ1: Challenges & Opportunities		3. What major obstacles do you see in the implementation of AI in supply chains, especially from the perspective of the various stakeholders you are aware of? 4. To what extent can AI contribute to the promotion of sustainability and the optimisation of global / international trade? 5. What regulatory or possibly ethical challenges are particularly relevant when integrating AI into supply chains?
RQ2: Possible Integration & Future Prospects		6. What best practices should be considered or do you consider promising for successfully and effectively integrating AI into supply chains?

		7. How will AI change the competitive landscape in supply chains and international trade? 8. Which new AI technologies (e.g. digital twins, predictive maintenance, machine learning, RPA, generative AI) could significantly influence the next stage of development in supply chain management?

9.3 Overview of Interview Participants

Interview	Interviewee	Position	Company	Company Size (Employees)	Industry
A	Werner Schwarz	Partner, ACENT AG (Ex CIO/CDO Gerolsteiner)	ACENT AG / Gerolsteiner	ACENT AG: 50 Gerolsteiner: 850+	Consulting / Beverage Manufacturing
B	Michael Kranz	Partner, ACENT AG (Ex Head of Digital at AUDI, Ex CIO at thyssenkrupp Steel)	ACENT AG / thyssenkrupp	ACENT AG: 50 thyssenkrupp: 100,000+	Consulting / Automotive / Steel
C	Sikko Zoer	Founder / Partner (Ex VP Global Supply Chain Distribution & Logistics) (Senior Advisor BCG)	Qwinn Business Partners / Medtronic	Qwinn Business Partners: 50 Medtronic: 95,000+	Medical Devices / Consulting
D	Anonymous A	Management Consultant	Consulting	50	Supply Chain Risk / Consulting
E	Jan Behnke	COO	b4dynamics	50	ERP Software / Technology
F	Astrid Rothaut	Head of DDIT International Commercial & Core	National Express Rail GmbH	850	Public Transportation / Railways

		Franchises (Ex SAP, Strategy&, Accenture, PWC)			
G	Anonymous B	Operations and IT Consultant (Ex-Danone, now Merck)	Biopharma	~64,000	Biopharma / Consulting / IT Strategy
H	Andreas Pfau	CIO / CDO	Bilfinger	~30,000	Industrial Services / Engineering

9.4 Interview Codes

9.4.1 Interview Code A

Interviewee: Werner Schwarz
Position and Companies: Partner, ACENT AG, (Ex CIO/CDO Gerolsteiner)
Interviewer: Vincent Habitzreuther
Interview platform: Microsoft Teams

Coded Transcripts Relevant Quotes

Citation / Statement	Main category	Inductive Code	Research Question
Any disruption in the supply chain, at any point, leads to performance losses—and ultimately costs money.	Organizational Dimension	Resistance and acceptance problems	RQ1
So—about six years ago now—I had the idea that we should try to generate these sales forecasts using AI. Specifically for short-term forecasting. The initial idea was to generate a forecast for the next 14 days. And 14 days of stability is enough to keep the supply chain in balance.	Technological Dimension	AI as an enabler	RQ1
Back then, AI still had something of an exotic or experimental image. And when someone showed up and said, 'Let's try this with AI,' you sometimes got strange looks. There were also comments like 'that's nonsense' or 'someone read too much in the weekend supplement of the Frankfurter Allgemeine—AI is	Organizational Dimension	Resistance and acceptance problems	RQ1

going to take over the world.'			
Yes, we had relatively favorable conditions. The company had existed for over 20 years at the time and had used a data warehousing system, so the relevant data was already available. We had comprehensive time series on product sales. But we also had market data and even weather data from the German Weather Service—about 38 different stations across Germany, providing historical weather data.	Technological Dimension	Data Management	RQ1
Absolutely. At the end of the chain, really. Funny that you mention that—I've actually given lectures on the topic. It's actually not a contradiction—using AI and pursuing sustainability—but quite the opposite. The leverage works like this: whenever I gain efficiency in a supply chain, whenever I avoid waste, I'm also making a contribution to sustainability.	Sustainability Implications	AI as an enabler	RQ2
The version that was ultimately adopted still has 180 pages. That alone creates a huge amount of uncertainty. Even companies like ours—application-oriented companies—now have to ask: What does this actually mean for us? What are we required to do? What are we allowed to do? What are we not allowed to do?	External Dimension	Regulatory hurdles	RQ1
In a country like Thailand, people are being trained in the same methods and the same subject areas as in Germany. And the services these graduates later develop or produce—they don't need to be shipped in a container to Europe. They are uploaded to the cloud—and then they're there. Available instantly. Consumable by anyone. And it's with those people that we'll be competing in the future—more	International Trade Implications	International competitiveness	RQ2

and more.			
The lab project itself was very good. I would absolutely do it again. Start low-threshold, achieve results quickly. I think that's a great approach, especially in digitalization projects: start fast, don't be afraid to fail fast. And if results are positive, then turn it into a classic project.	Best Practices & Future Prospects	AI as an enabler	RQ1

9.4.2 Interview Code B

Interviewee: Michael Kranz
Position and Companies: Partner, ACENT AG (Ex Head of Digital Experience AUDI, Ex CIO & Head of Digital Solutions thyssenkrupp Steel)
Interviewer: Vincent Habitzreuther
Interview platform: Microsoft Teams

Coded Transcripts Relevant Quotes

Citation / Statement	Main category	Inductive Code	Research Question
You need to understand that data is generated within a process, and if the process is not properly set up, you end up with poor-quality data...	Technological Dimension	Data Management	RQ1
Even basic machine learning algorithms can qualify as a kind of AI ... and you can already achieve quite a lot with them.	Technological Dimension	AI as an enabler	RQ1
One of the biggest challenges is building trust in the results that an algorithm or AI delivers.	Organizational Dimension	Resistance and acceptance problems	RQ1
AI could help here by ensuring better capacity utilization or more efficient route planning — which would	Sustainability Implications	AI as an enabler	RQ2

already be a contribution to sustainability.			
Supply chains can also be considered part of critical infrastructure... the regulation becomes relevant.	External Dimension	Regulatory hurdles	RQ1
I always involve people right from the start... That has always been a success factor in all of our projects.	Best Practices & Future Prospects	AI as an enabler	RQ2
Whoever manages to use the technology in a way that optimizes processes and creates a competitive advantage is one step ahead.	International Trade Implications	International competitiveness	RQ2
Blockchain... has been discussed for a long time — especially in relation to self-organizing systems in supply chains.	Technological Dimension	AI as an enabler	RQ1
The real question is: How can I increase the resilience of my supply chain? That could be a key application area for AI...	Sustainability Implications	AI as an enabler	RQ2

9.4.3 Interview Code C

Interviewee: Sikko Zoer
Position and Companies: VP Global Supply Chain Distribution and Logistics, Medtronic (Senior Advisor BCG)
Interviewer: Vincent Habitzreuther
Interview platform: Microsoft Teams

Coded Transcripts Relevant Quotes

Citation / Statement	Main category	Inductive Code	Research Question
If companies want to work successfully with AI , they need to establish a comprehensive data management process...	Technological Dimension	Data Management	RQ1
We implemented automated invoicing using optical recognition systems... and there was some light machine learning behind it.	Technological Dimension	AI as an enabler	RQ1
Beyond the data and the process, there's a third dimension: people... There's a lot of resistance in Europe—concerns about privacy, personal job security...	Organizational Dimension	Resistance and acceptance problems	RQ1
AI can be a powerful enabler in that context. First of all, it can make your supply chain network more visible and transparent...	Sustainability Implications	AI as an enabler	RQ2
This is where I see a huge role for AI, because much of this work is repetitive and rule-based. It's ideal for automation.	International Trade Implications	AI as an enabler	RQ2
I always say: start small, think big, scale fast... Identify a few business cases and pick a small one...	Best Practices & Future Prospects	AI as an enabler	RQ2
What I see—and not just with AI, but	International Trade Implications	International competitiveness	RQ2

in general—is that Europe is significantly behind. I expect that power will shift even more toward the U.S. and China.			
Especially in supply chains, that could have a massive impact. Imagine distribution centers where there are no human workers walking around anymore...	Technological Dimension	AI as an enabler	RQ1
People always focus so much on the technology... But to really build something sustainable and successful, it takes more...	Organizational Dimension	Resistance and acceptance problems	RQ1

9.4.4 Interview Code D

Interviewee: Anonymous A
Position and Companies: Operations and Management Consultant, SCRM Consulting GmbH
Interviewer: Vincent Habitzreuther
Interview platform: Microsoft Teams

Coded Transcripts Relevant Quotes

Citation / Statement	Main Category	Inductive Code	Research Question
In the projects we've worked on, we've mostly seen that many of them fail due to poor master data quality... those are the real challenges companies are facing.	Technological Dimension	Data Management	RQ1
AI can help evaluate massive datasets in that context... but at	Technological Dimension	AI as an enabler	RQ1

some point, it reaches its limits. This is where self-learning AI algorithms can handle things a bit better.			
Many companies still treat IT as merely an administrative function... they don't really see IT as a strategic asset or potential value driver.	Organizational Dimension	Resistance and acceptance problems	RQ1
If it were implemented optimally, all systems would communicate with each other and there'd be no need for human intervention... and that directly links to sustainability, of course.	Sustainability Implications	AI as an enabler	RQ2
That's why we often start with workshops... What's important to you? What do you actually want to achieve? That's the most critical part.	Best Practices & Future Prospects	AI as an enabler	RQ2
I believe we'll see strong market consolidation... systems become better integrated and automated, everything will become leaner and faster.	International Trade Implications	International competitiveness	RQ2
So I believe, as I said, in the first stage, companies need to first clear the table so that	Organizational Dimension	Resistance and acceptance problems	RQ1

their IT organization is cleanly structured...			
Digital Twins... I think that's currently the highest-use case that can realistically be built... to control all integrated parts together.	Technological Dimension	AI as an enabler	RQ1
Efficiency always translates into sustainability. So when something becomes more efficient, it also becomes more sustainable.	Sustainability Implications	AI as an enabler	RQ2
If you try to implement AI directly, you'll fail in supply chains. You have to take baby steps first, gradually improve things.	Best Practices & Future Prospects	AI as an enabler	RQ2

9.4.5 Interview Code E

Interviewee: Jan Behnke
Position and Companies: COO, b4dynamics
Interviewer: Vincent Habitzreuther
Interview platform: Microsoft Teams

Coded Transcripts Relevant Quotes

Citation / Statement	Main category	Inductive Code	Research Question
But again, regardless of AI... the data is always important: the data quality, data access – and, of course, comprehensive data access.	Technological Dimension	Data Management	RQ1
With all the MRP topics... now it just does it again – that's the only	Technological Dimension	AI as an enabler	RQ1

difference now with Dynamics: they put it into an AI assistant.			
That's still a pretty big issue at the moment – regulating first and then developing something. And of course that's incredibly difficult...	External Dimension	Regulatory hurdles	RQ1
The biggest challenge for companies is to first make the knowledge transparent... be it in heads, DMS systems, or ERP.	Organizational Dimension	Resistance and acceptance problems	RQ1
It should help the companies themselves to be able to deliver more quickly... recognise future requirements based on historical data.	Sustainability Implications	AI as an enabler	RQ2
The same applies to my suppliers... shorter delivery times throughout the entire supply chain – and then also internationally.	International Trade Implications	International competitiveness	RQ2
Currently building an assistant – a bot – with Copilot Studio to support our consultants in their daily work.	Best Practices & Future Prospects	AI as an enabler	RQ2
We currently use AI in the area of incoming invoice scanning and in the incoming document process in general...	Technological Dimension	AI as an enabler	RQ1
If you want to get started with AI at	Best Practices & Future Prospects	AI as an enabler	RQ2

companies, you shouldn't try to implement the biggest solution straight away...			

9.4.6 Interview Code F

Interviewee: Astrid Rothaut
Position and Companies: Head of IT, National Express Rail
Interviewer: Vincent Habitzreuther
Interview platform: Microsoft Teams

Coded Transcripts Relevant Quotes

Citation / Statement	Main category	Inductive Code	Research Question
Only when the data is clean — not duplicated, not ambiguous, clearly categorized — can you truly achieve impressive results with AI.	Technological Dimension	Data Management	RQ1
That's why when I see these so-called "new" AI technologies, I'm often skeptical. Because honestly, most of these things already existed...	Technological Dimension	AI as an enabler	RQ1
There's a lot of resistance in Europe — concerns about privacy, personal job security, and simply a fear of the unknown.	Organizational Dimension	Resistance and acceptance problems	RQ1
AI can help with planning — for example, identifying the ideal time to order a container, based on when prices are lowest.	Sustainability Implications	AI as an enabler	RQ2
If other companies are using AI too —	International Trade Implications	International competitiveness	RQ2

and if they all target the same containers at the same times — then prices will rise again.			
Best practice is to clean up your data before you even get started.	Best Practices & Future Prospects	Data Management	RQ2
Companies need to start exploring what AI actually means, learn from it, and just begin doing it. But start small.	Best Practices & Future Prospects	AI as an enabler	RQ2
We're still struggling with many aspects, including neural networks... But when it comes to automation and algorithms, yes — we'll continue to see progress.	Technological Dimension	AI as an enabler	RQ1
Coordination is becoming more complex. AI can help us level this out, simplify things — but it's not going to become "easy."	International Trade Implications	AI as an enabler	RQ2
But a chatbot just predicts what I want, and yes, the algorithm is pretty good... AI doesn't think. It's an algorithm. It's math.	Organizational Dimension	Resistance and acceptance problems	RQ1

9.4.7 Interview Code G

Interviewee: Anonymous B
Position and Companies: Head of DDIT International Commercial and Core Franchises, Merck Group
Interviewer: Vincent Habitzreuther
Interview platform: Microsoft Teams

Coded Transcripts Relevant Quotes

Citation / Statement	Main category	Inductive Code	Research Question
You need data. Very good quality data. And until recently, there wasn't a strong enough need to have the highest accuracy of master data... there are still quite a few silos.	Technological Dimension	Data Management	RQ1
Of course, you can also use this to fine-tune your supply chain for sustainability... that's the most sustainable way—instead of using a dedicated airplane.	Sustainability Implications	AI as an enabler	RQ2
And you have also ethical challenges. Oh yes—these are real. In a way, you have to keep the humans in the loop.	External Dimension	Regulatory hurdles	RQ1
Now, with globalization reversing, with added tariffs and all, it might be that some companies will move back into more so-called near-shoring. But then, they'll invest more in automation and in AI.	International Trade Implications	International competitiveness	RQ2
So I would say, if you want to invest 5 million in AI, maybe spend 2 million on actually applying the technology, and 3 million on streamlining your processes... Not just	Best Practices & Future Prospects	AI as an enabler	RQ2

putting all 5 million into AI.			
Technology is there, but to make it work sustainably inside a company, it requires a systemic change—not just, you know, putting lipstick on a pig.	Organizational Dimension	Resistance and acceptance problems	RQ1
Now, you have several vendors of software that are really supporting companies like mine and others to take steps in this direction... and then choose the one that focuses on the best and most efficient financial impact.	Technological Dimension	AI as an enabler	RQ1
You really need to plan your supply chain differently... And maybe you can even shift priorities each quarter—it depends on the products you sell, right?	Organizational Dimension	Resistance and acceptance problems	RQ1
I don't think we lack innovation in Europe. We do innovate. But I think we are terrible at scaling...	International Trade Implications	International competitiveness	RQ2
And if you add the challenges around it, it's also the skills of people in the organization... it's even a skill issue just to work with data.	Organizational Dimension	Resistance and acceptance problems	RQ1
But cyber security threats are also a challenge when really going all-in, because once you	External Dimension	Regulatory hurdles	RQ1

automate and connect everything via the internet, cyber threats become an issue.			
If I can help a company stay up to date with the latest regulations—and use websites where all these rules are published in every country... That's a great use case.	Best Practices & Future Prospects	AI as an enabler	RQ2

9.4.8 Interview Code H

Interviewee: Andreas Pfau
Position and Companies: CIO/CDO, Bilfinger
Interviewer: Vincent Habitzreuther
Interview platform: Microsoft Teams

Coded Transcripts Relevant Quotes

Citation / Statement	Main category	Inductive Code	Research Question
The main challenge you always face when implementing AI is of course the question: on what data basis is the AI trained? ... So yes, the obstacles are definitely data availability and data security—both from the perspective of those who want to use the data and from those who have to provide it.	Technological Dimension	Data Management	RQ1
From the perspective of Bilfinger, promoting sustainability always goes hand in hand with efficiency. So	Sustainability Implications	AI as an enabler	RQ2

wherever we act more efficiently ... things become more sustainable.			
Ethical challenges are always present when we ask to what extent something like a market overview—generated by AI—creates unfair preference. ... For example, suppliers who provide more data might automatically perform better or get better treatment.	External Dimension	Regulatory hurdles	RQ1
Yes, so if you bring it to that level now, then yes. I would even want to include the Asian countries in the comparison ... what can be achieved without ethical boundaries—also in relation to supply chains.	International Trade Implications	International competitiveness	RQ2
Promising success always comes from starting small and thinking big. Don't aim for the giant leap from the beginning. Take small steps to approach the bigger picture gradually.	Best Practices & Future Prospects	AI as an enabler	RQ2
What we've known as 'traditional trade,' in my view, will increasingly require transparency ... AI and agent-based AI will, in my view, fundamentally revolutionize that	International Trade Implications	AI as an enabler	RQ2

space.			

9.5 Interview Transcripts

9.5.1

Interview A

Vincent Habitzreuther
Yes, I also have it running on my phone—everything is fine.

Werner Schwarz
So, I studied general mechanical engineering in Karlsruhe and started my professional career at Linde AG in the area of production process organization and production.

I also had the luck and privilege of setting up and managing a factory abroad for the company over the course of two years.

That means I was responsible for all logistics and production planning topics. So, when we now talk about questions like how AI can ultimately help in optimizing supply chain management, I basically know both sides. And that's perhaps a bit of a special feature.

Since the beginning of the year, I've been with ACE and, as consultant and partner, responsible for the topic of Smart Manufacturing—ultimately, the exact kind of questions we'll be exchanging thoughts about today.

Vincent Habitzreuther
Cool. Exactly—the second question from the first topic actually goes hand in hand with this a little. So now the industry and company size are clear—where you are currently, where Michael is, and what you are basically doing together there.

Werner Schwarz
Yes, but I'd be happy to say a few more words about the last company, because I believe that most of what I can contribute to these questions is based on what I did in that company.

So, the company is the market leader in Germany for non-alcoholic soft drinks. Just to give you some figures: the company generates a turnover of approximately 350 million euros and operates predominantly—about 97 percent—on the German market.

And by non-alcoholic soft drinks, I mean mineral water, flavored waters, sodas, and the like—and in significant quantities. We're talking about nearly a billion bottles produced per year.

So logistics is one of the most important topics in such a company. As a mass producer, the processes have to run with extremely high efficiency.

Any disruption in the supply chain, at any point, leads to performance losses—and ultimately costs money.

That's why you naturally try different methods to ensure that the supply chain really does

function as efficiently as possible. And that was part of my responsibilities.

I'm already leaning a bit toward question two—what were the main challenges?

One of the most important questions for such a company is the accurate estimation of sales in the near future. Of course, also for the more distant future—but even short-term forecasts are essential.

Because all the gears in a company interlock, and they depend on how well you can forecast sales for the next few weeks. If I make incorrect assumptions there, then the gears turn too slowly, too quickly, or in the wrong direction.

That really runs through the entire supply chain like a red thread.

It affects the efficiency of the systems. I may need to plan for quicker product changes on the equipment than originally intended.

This might mean overtime shifts for employees on weekends. Or: do I have enough returnable bottles to handle the planned production?

Do I have enough freight capacity to actually deliver the goods to the customer?

All the way to the procurement of pipe systems and operating materials—because when you're working at the scale we're talking about, you can't just improvise at short notice. It has to be planned very precisely from the beginning.

And all of that depends essentially on the accuracy of the sales forecast—it determines the efficiency and ultimately the profit or loss of the entire supply chain.

So—about six years ago now—I had the idea that we should try to generate these sales forecasts using AI .

Specifically for short-term forecasting.

The initial idea was to generate a forecast for the next 14 days. And 14 days of stability is enough to keep the supply chain in balance.

The main obstacles back then were, above all, related to the fact that this was six years ago. At that time, AI wasn't nearly as widespread or present in the public consciousness as it has become over the last two years.

Back then, AI still had something of an exotic or experimental image.

And when someone showed up and said, "Let's try this with AI," you sometimes got strange looks.

There were also comments like "that's nonsense" or "someone read too much in the weekend supplement of the *Frankfurter Allgemeine*—AI is going to take over the world." No idea.

Vincent Habitzreuther

Hello Werner, are you still there? Hello, hello. I can't hear you anymore—if you can still hear me...
So... I can't hear you anymore. Can you hear me?

Werner Schwarz
Now it's working again.

Vincent Habitzreuther
Weird, I don't know either. But now I can hear you again. Can you hear me well too?

Werner Schwarz

Oh—so, now again?

Vincent Habitzreuther
Yes—hello, hello—test. Yes, yes, okay. Okay, it works—great.
Weird, sorry—sometimes I have a bit of a bad connection here. I'm in Portugal, at my girlfriend's parents' house.

Werner Schwarz
Yes—so where should I start again?

Vincent Habitzreuther
We were at the point where you said, if someone had just read the *Frankfurter Allgemeine* saying AI is going to take over humanity, then everyone kind of reacts like, "Oh!"—and it all felt a bit like witchcraft.

Werner Schwarz
Exactly.

So that's why it was clear that if I wanted to seriously address the topic, then the only way was not to initiate a huge project with a big budget and massive resources.

Instead, we did what we called a "lab project."

That means we ran experiments with minimal resource use. From a methodological perspective, it was done using a Jupyter Notebook—I don't know if that means anything to you.

It's a platform for Python scripting that allows you to integrate the appropriate libraries.

And that's where we made our first attempts.

It was actually quite interesting—a student worked on it. A very special student with exceptional skills.

He had just finished high school and is now studying computer science in Karlsruhe. Really an absolutely brilliant guy.

And I was able to bring him on board for three months.

He got to work building models, and we fed in various time series data, which we then used to train the models.

After six weeks, we already had models that were 25 percent better in terms of forecast accuracy than our planners—some of whom had been doing this for 20, 30 years.

That caused a serious stir.

And it opened people's eyes.

For the first time, we had a concrete example where you could really see: this is how AI can be used to solve a business challenge.

You could see the kind of results it can achieve—and that these results are clearly better than what you can get with traditional methods.

And it didn't just open people up to that specific topic. From that point on, it was clear that AI could be a method—a tool—for answering a wide range of questions in the company.

So yes, it was a real eye-opener.

Afterwards, when I brought up completely different topics and said, "Hey, let's try to solve this or that using AI," the willingness to explore those ideas was suddenly much greater.

That was partly because I used this sales forecast example and turned it into a sort of roadshow—I told the story to anyone who wasn't up in a tree at the time.

Because it's a topic that, depending on how you present it, can be explained really well.

If you show two curves—how the forecast looked before, and how it looks now—and you just see how precisely the new forecast works, then you get a real feel for how well that kind of task can be solved.

And from there, it becomes relatively easy to transfer that idea to completely different kinds of questions.

So yes, the willingness to tackle other issues with AI really grew significantly because of that.

Vincent Habitzreuther
Understand. And did that have something to do with it—when you say you were able to predict it better—was that because you already had good data and were able to benefit from it? Or did you restructure it for the AI?

Werner Schwarz
Yes, we had relatively favorable conditions.

The company had existed for over 20 years at the time and had used a data warehousing system, so the relevant data was already available.

We had comprehensive time series on product sales. But we also had market data and even

weather data from the German Weather Service—about 38 different stations across Germany, providing historical weather data.

And when you do such a project, it's actually very typical not to make a prediction into the future, but to simulate a past date—say, for example, January 1, 2024.

We use the time before 2024 for training and the time after for forecasting.

All of this information is then fed into the AI model.

Now, 2024 is already in the past. Today is March 12. So I already know what happened in 2024.

That allows me to compare the AI's forecast with what actually happened. I don't have to wait for the future to occur to check the accuracy—I can do that right away.

These were all favorable conditions that allowed us to build very accurate forecasts.

I do have to include a caveat though:

What we've learned over time—and this became clear even during the lab project—is that the AI model only performs as well as the data it has access to.

There may be real-world events that happened, but the model doesn't know about them.

Let me give you an example from supply chain:

When we connected a new, large customer, there was an effect called *pipeline filling*.

That means we initially pushed goods into the market to fill up all the logistics buffers—warehouses, retail shelves, and so on.

Once those were full, we then had regular sell-out at the point of sale.

So when bringing on a new customer—or even when launching a new product—you initially see a large sales spike. Then it drops back down.

If you just look at the time series without knowing that context, it seems odd. Suddenly there's a spike, and then it decreases.

That's why the system has to be taught.

At first, that anomaly creates a visible delta between the forecast and reality.

And that's when what I call the *fundamentalists* show up—just like in stock markets.

There are two groups: one are the *technicians*, who try to build purely technical forecasts. The others are *fundamentalists*, who try to understand market context.

The fundamentalists look at the data and say: "Yes, of course—that's because we onboarded a

customer. Pipeline filling. Makes total sense."

The technicians wouldn't see that right away.

But when these two groups talk to each other, that information flows.

Once the technicians understand there was pipeline filling, they can reflect that in the models.

Then domain knowledge meets technical knowledge, and the forecast improves.

We saw this again and again: over time, forecasts became more and more accurate.

And that's perhaps something very typical when using AI in the supply chain.

There are always opportunities to improve AI models—not by tweaking parameters, but by identifying which additional information helps the model explain future events more accurately.

To jump ahead a bit: after those positive results, we turned the lab project into a full-scale implementation.

There were many other components involved. But especially on the content side, we kept refining.

By now, we've reached a level where the forecasts aren't just 25% better—but 40% better than what we previously achieved through manual sales forecasting.

Also, in terms of quality, there has been a significant improvement.

And that's because we better understand how AI models work in different domains.

It's important to transfer domain-specific knowledge into those models.

One particular challenge we faced: we started the lab project in 2019. The actual project began in 2020—and then came COVID.

Which meant that the entire time series didn't account for the pandemic.

That had massive impacts for the company.

Suddenly, restaurants were closed overnight—no more sales of restaurant-sized bottles.

Then there was panic buying—hoarding. In one month, sales were suddenly 30% above plan—and dropped sharply again the next.

Why? Because everyone's basement was full of drinks.

We recognized it was due to COVID and started integrating *Corona vectors* into the model.

We brought in R-values from the Robert Koch Institute, incidence rates, and lockdown

indicators by federal state.

The model learned surprisingly quickly—even with these kinds of disruptions in the normal supply chain.

Even those types of mid-term distortions can be integrated effectively. It worked.

Maybe one more thing:

The lab project itself was very good. I would absolutely do it again.

Start low-threshold, achieve results quickly. I think that's a great approach, especially in digitalization projects: start fast, don't be afraid to fail fast.

And if results are positive, then turn it into a classic project.

We had that too.

A classic project means: you now need a platform that can host such models.

You go through selection processes, find a partner that can operate the model in the cloud.

Then the topic of interfaces comes in: you have to feed such models continuously with data.

You also have to bring the output back into your supply chain planning processes.

So now you have interface requirements.

Then there's monitoring: are the interfaces working properly?

Is the forecast quality changing? Improving? Getting worse?

These are the kinds of questions that come on top in such a project—and they shouldn't be underestimated.

While we had meaningful results in the lab after six weeks, it took about nine months before we could use the system productively.

Vincent Habitzreuther
Maybe just to follow up—you increased your efficiency there, so to speak. And yes, that always has something to do with sustainability.

Werner Schwarz
Absolutely. Absolutely. At the end of the chain, really.

Funny that you mention that—I've actually given lectures on the topic.

It's actually *not* a contradiction—using AI and pursuing sustainability—but quite the opposite.

The leverage works like this: whenever I gain efficiency in a supply chain, whenever I avoid waste, I'm also making a contribution to sustainability.

Werner Schwarz
Yes.

Any time I fall short of sustainability goals—whether it's wasting energy, resources, or transport capacity—it's a result of inefficiencies.

If I don't have an optimized supply chain, if it's not running efficiently, then I automatically lose out on sustainability benefits.

In that respect, I believe this is one of the most prominent examples that shows sustainability and economic goals are *not* a contradiction—on the contrary, they go hand in hand.

Vincent Habitzreuther
Interesting, exciting—yes.

Yesterday I spoke with someone—he used to work at Medtronic. That name probably rings a bell, right?

Werner Schwarz
No, doesn't ring a bell. No.

Vincent Habitzreuther
They do health tech—a huge healthcare company. He was Global Head of Supply Chain there.

And he said—now moving to the next point, about regulation—he said he finds it really unfortunate that here in Europe, we always regulate first and then drive innovation.

Whereas in other regions—especially China and also the U.S.—it's the other way around: first you explore what's possible, and then you regulate it.

What do you think about that? How should we handle this in Europe—and especially in Germany?

Why is data protection such a massive issue?

Werner Schwarz
Yes, well—it's not just about data protection.

I mean, take the example we're talking about right now—it actually has absolutely *nothing* to do with data protection. It's a very technical topic.

But even so, I now realize that there are major regulators involved—like the EU AI Act.

When I read the first draft, it was 400 pages long. An unbelievable document.

The version that was ultimately adopted still has 180 pages.

That alone creates a huge amount of uncertainty.

Even companies like ours—application-oriented companies—now have to ask:

What does this actually mean for us? What are we required to do? What are we allowed to do? What are we *not* allowed to do?

There are now a whole series of obligations that come from the EU AI Act which you have to fulfill—even just to implement something as seemingly obvious as this.

Let me give you an example.

Vincent Habitzreuther
Your voice is gone.

Werner Schwarz
I don't know why—can't hear you anymore.

Vincent Habitzreuther
Is it working again now?

Werner Schwarz
Yes—now I can hear you again.

Vincent Habitzreuther
So—today, I would have to educate *everyone* who is involved in the process at any point, so that they understand how such an AI system works—what they can expect from it.

I would have to explain to them how these models work and so on.

But people aren't interested in that.

And yet it's a bureaucratic hurdle I have to clear.

I might even have to *document* all of that.

And then, at some point, auditors will come along—and I'll have to prove whether people were appropriately trained or not.

And that's unfortunate, because it creates barriers.

It slows you down—keeps you from acting quickly with these new methods that can actually bring advantages to your business.

And not just advantages compared to direct competitors here in Germany—but in an international context, too.

Let me go on a little tangent to make this clearer:

Last year I was in Thailand. Also in Laos and Vietnam.

And I have a special connection to that region—I worked in Thailand for two years.

The factory I mentioned earlier—the one I built—was a factory in Thailand.

So I spent two years there building a factory.

And during my recent trip, I took the opportunity to visit a university in Bangkok—Ramkhamhaeng University.

How many students does your university have?

Vincent Habitzreuther
For the Master's program, I think around 2,000. Bachelor students maybe 4,000. So—not a lot, it's actually quite small.

Werner Schwarz
Okay—for comparison: that university has 600,000 students.

Vincent Habitzreuther
Okay, good—we don't have much left. With everything going on—IT, meds, and all that... Not so much about life itself, for God's sake.

Werner Schwarz
It was really exciting to see that.

I went into the university library there. And the library, in principle, looked just like any university library we know from Germany.

Vincent Habitzreuther
Like in Karlsruhe, yes.

Werner Schwarz
Exactly. There were students sitting in the reading room, with a few books on the table and a tablet next to them.

So, even in terms of tools—it was absolutely comparable to what you'd find in Germany.

Then I went through the inventory of books available for loan—just to check what kind of books they had there.

And then I got stuck on one book: *The Basics of Data Science*.

I opened it. Of course, I couldn't read the text—but the mathematical formulas? They were exactly the same.

And when you look at it like that, it suddenly becomes very clear:

In a country like Thailand, people are being trained in the same methods and the same subject areas as in Germany.

And the services these graduates later develop or produce—they don't need to be shipped in a container to Europe.

They are uploaded to the cloud—and then they're there.

Available instantly. Consumable by anyone.

And it's with those people that we'll be competing in the future—more and more.

And yet, here in Europe, we don't come up with anything better than launching a 180-page regulation document as a first step.

We initiate heavy-handed regulatory measures, although we *know*—and can see—that we are competing against talent from such countries.

Talent that is just as skilled as we are—and not subject to any of these regulatory burdens.

So yes, I see this with great concern. That we might be throwing the baby out with the bathwater—and that we're overregulating ourselves in situations like this.

Vincent Habitzreuther
Yes, that's really insane.
I wouldn't have thought there were 600,000 people…

Werner Schwarz
Well, not all of them are studying Data Science.

Vincent Habitzreuther
Sure, but they're all enrolled at *one* university. I get that—yes, yes.

Werner Schwarz
And the thing is—they really are...

For fun, after I got back from the trip, I looked up their curriculum for Data Science.

I know the German curricula fairly well—especially in Data Science. Georg Steiner, for example, was a dual student—he trained as a data scientist at DHBW in Mannheim.

So I know their curriculum. And the one from Thailand is practically the same.

They have a few extras that I found really interesting.

For example, their curriculum includes quite a number of lectures on ethical questions.

I think that's totally fascinating. That doesn't exist here in Germany.

They've got the usual stuff too—basics of database design and all that.

But the ethical foundations? They're well covered there.

Aside from that, the programs are about 90 percent identical.

Vincent Habitzreuther

You already mentioned earlier that we in Europe might get left behind. That ties in with question 3.2, about how AI is changing the competitive landscape.

Maybe we can directly connect that with question 3.1:
What would you say, or what are you currently doing at Ascent—that's how you pronounce it, right? Ascent like "to ascend"?

What best practices do you have when advising a client? When you say, “Look, if you want to be successful, you have to do this”?

Werner Schwarz
Yes, great question.

So first of all, we notice that our clients simply have a need for guidance. They’re looking for orientation. They’re aware that something is evolving in this space, and they’re asking: “How can I use this for myself?”

This push really gained momentum when ChatGPT entered the scene. It’s incredible to see the wave it triggered within companies.

AI and AI-based processes have existed much longer, of course. I, for example, did my first projects in this area back in 2019.

ChatGPT was released in October 2022—and that really created a wave, leading to companies asking:
“What can I do with this now?”

But that also created a downside: many now believe ChatGPT *is* AI. But it’s not—it’s only a part of it.

A whole range of questions, like sales forecasting, can’t be solved with ChatGPT or a large language model.

So part of the consulting effort is to untangle that confusion and bring structure and clarity into the topic.

We help clients understand what *they* can do to solve specific operational or strategic business challenges using AI.

Exactly. The topic is still relatively new for Ascent, too.

Ascent is an IT consulting company that’s active in a few fields. One side focuses on strategic IT consulting; the other handles classic IT project management.

Let’s say a client comes and says, “I have a fragmented IT landscape—how can I consolidate this?”

Or they need to manage a complex IT migration—these are the traditional topics Ascent has worked on.

But of course, we also need to expand our consulting capabilities. When clients start asking how they can use AI to solve specific questions, then they rightly expect answers from a modern consultancy.

And we're addressing this by continuing to build and expand our own expertise.

That might have been one of the reasons why there was interest in bringing me on board at Ascent.

I haven't been here long—just two and a half months so far.

Partnerships also play a major role. There are many young companies that are highly skilled in AI development, but they often lack broader business context.

That creates a fertile ground for partnerships—where we can bring things together in a meaningful way for our clients.

Vincent Habitzreuther
Yes, I see.

We have another question listed here—one you've already touched on a bit.
There are various technologies or foundations that AI builds on—language models, generative AI, and so on.

What's your view on this? Which ones do you think have the potential to take most companies—especially in the supply chain environment—to the next level?

Werner Schwarz
Yes—if I may say so, I think we're often putting the cart before the horse here.

I'm more of a believer in asking:
"What does your supply chain look like?"

What's your guiding principle or philosophy?
What do you orient yourself by?

It could be something like saying,
"I want to align with the principles of Industry 4.0."

Or:
"I'm using the classic SCOR model—the Supply Chain Operations Reference Model—as my orientation."

When I do that, I automatically come across questions where AI can help me find better answers.

Let's take Industry 4.0, for example—it includes six different maturity levels.

The first step is basic automation: a machine is controlled by a computer.

Then, the computers are networked.
Next, I start collecting data—observing what's happening.

The following step: I begin to recognize patterns and understand why things happen.

When I recognize those patterns, I can move to the next level: I can predict.

So, as part of that framework—when I want to boost production or make my supply chain more efficient—one of my goals becomes:

"I want to predict what's going to happen."

For example, I'm tracking a quality parameter. If it continues on a certain path, I want to know *when* it will cross a critical threshold.

That's a classic use case for AI.

Or: If I want to make my supply chain more resilient.

That means I want to be able to recognize disruptions quickly and take immediate countermeasures.

Then I might install an AI system in my production planning processes.

And now I have a *concept*.

I'm not saying:
"I have an AI—what can I solve with it?"

That's like the old saying:
"To a person with a hammer, every problem looks like a nail."

And sometimes I feel like that's how AI is being treated.

What I believe in are higher-level concepts—like Lean Management or Industry 4.0—and from there, I ask:

"How can AI help me achieve *those* goals?"

That's the path I find most compelling.

Vincent Habitzreuther
Cool. That makes total sense.

With the topic of Industry 4.0—I haven't dealt with that yet, at least not as part of this thesis.

But it's probably also really exciting to take a closer look at that.

Werner Schwarz
Yes, absolutely. Especially because it's not just a project—it's truly a *philosophy*.

That's how one has to understand it.

And since it's built around developmental stages—
at level 5, for example, you enter into forecasting territory, where predictive capabilities start to matter.

Level 6 is when you actually start to *intervene* in processes *based* on those forecasts—
to ensure in advance that you don't violate certain parameters or rules.

That's level 6.

And because it's structured like that, I truly believe that AI is a tool—
one that can support so many different areas and help achieve the goals of Industry 4.0 in a real, practical way.

Vincent Habitzreuther
That sounds like a great conclusion.

Yes, I think so. And just as feedback—it's super cool how much you know about this.

Also the interview with Michael, and now this one with you again—

If I were a startup or a company, I'd definitely bring you on board.

Werner Schwarz
[Laughs.] Yes.

Vincent Habitzreuther
Cool. Okay—how many interviews do I still have planned in total?

I think I'll do about four more from here on out.

VINCENT HABITZREUTHER
Okay.

Vincent Habitzreuther
We're aiming for around eight to ten interviews.
You can always do more, of course—but we don't have endless space for it.

After all, you still have to write the main body of the thesis.
The more material, the harder it becomes to extract clear findings.

So, you have to strike a bit of a balance.

But yes—somewhere around that range is what it will probably end up being.

VINCENT HABITZREUTHER
Yes, cool. And if I ever see you, I definitely owe you a beer or two.

Werner Schwarz
[Lacht.] All good.

9.5.2

Interview B

Vincent Habitzreuther
Do you see something?

Michael Kranz
Yes, the transcription has started. Otherwise, I don't see anything yet. Nothing yet? Wait, then. But I do have it in front of me.

Vincent Habitzreuther
You even said it out loud – not bad. I'll share it anyway, just in case. That way, you have it in front of you once again.
Alright. We always begin like this. I've structured it into three points. And to start off, maybe just briefly tell me what you do, where you're from, what your connection is to the topic, and what kind of experience you've had with it so far.

Michael Kranz
Alright, so I'll just go ahead and start now.
You just go ahead, exactly.
Okay, all clear.

My name is Michael Kranz, I'm 62 years old.
Professionally, I've spent most of my life working in IT roles for industrial companies. The last major company I worked for was ThyssenKrupp Steel, where I served as CIO for nearly ten years.

But when it comes to supply chains, Krones AG is also worth mentioning – a medium-sized company that manufactures bottle-filling systems and operates worldwide.
So, regarding supply chain management: if we go back to the steel industry, supply chains have always been one of the key topics. That's simply due to the fact that you have highly specific requirements for steel – also in terms of dimensions – and at some point, customer relations come into play, as well as the need to handle these heavy materials within logistics.

It starts with raw materials: how do I handle raw material logistics? And it continues all the way to logistics for finished goods.
So, supply chain optimization has always been a major topic – and we can return to that later.

At the moment, I'm no longer working as a CIO but as a consultant at ACENT.
Right – I've seen that.

Exactly. We are mainly all former CIOs – we've sat on the other side of the desk, so to speak – and that's why we now advise our clients based on a wealth of experience and personal responsibility.
So, the types and sizes of industrial companies we deal with today are more or less the same as the ones I was responsible for as the head of IT.

We can absolutely keep going – I'll keep bringing up the topic of steel from time to time as an example.

Vincent Habitzreuther
Yes, great. Then you've already summarized the first two points quite well.
Maybe now a first real content-related question:
What obstacles do you see in implementing AI in supply chains, especially from the perspective of different stakeholders?
Just share your perspective on it.

Michael Kranz
Before we dive into AI – may I make a quick preliminary remark?
Of course, please do.

Optimizing supply chains has always been an issue – as has the automation of certain tasks. The goal has always been to manage complex framework conditions, which often contradict each other during optimization, and still try to find the best possible outcome within these complex supply chains.
That has always been a topic.

Now, of course, a new technology enters the picture – in this case, AI .
It's certainly worth taking a closer look at the term itself:
What exactly is artificial about it, and what's intelligent?

Nowadays, we primarily refer to tools like ChatGPT, Gemini, or similar large language models. And yes, when you look at those, you think: "That's brilliant – that's AI!"

But in that context, people often forget that you can already achieve quite a lot using very basic machine learning algorithms.
Even that can already qualify as a kind of AI – simply based on numerical data.
You might even call it classical AI, in contrast to large language models, which deal more with human–machine interaction.

So if I now look at supply chains, we're mostly dealing with what I would call classical AI. But someone who evaluates these technologies might also say that large language models could be useful here.

Now, where do we see obstacles?

As is often the case when optimizing something through IT – whether AI or not – we first have to acknowledge that the people involved usually carry a lot of responsibility.
And many of them find it difficult to delegate that responsibility to a system.

That means one of the biggest challenges is building **trust** in the results that an algorithm or AI delivers.

I once casually said: "I don't trust anyone to do something in Excel that I can't recreate myself."
It's not about me, but there are people who say, "I need to understand what comes out of this."
And that's exactly the case with AI – especially when neural networks or machine learning are involved – it becomes increasingly difficult to understand how results are generated

So, can I just say:
"Okay, I trust what the AI delivers, even if it contradicts my own experience?"
Then I have to reflect and think: "Well, I could've come to that conclusion myself – or maybe not – maybe I should give it a try and see if it helps."

And so, gradually, you have to build trust in these results.
That, I believe, is the biggest hurdle for stakeholders.

Vincent Habitzreuther
I've already discussed this with other interviewees, and many of them — including my professor, who is also actively engaged with the topic — often point out the same issue:
Companies that would actually benefit from concrete use cases often struggle with data.
They either cannot interpret the amount of data, don't understand it properly, or simply fail to utilize it effectively.
What do you think?

Michael Kranz
This is where the Excel topic comes into play again — that was meant a bit jokingly, of course.
But at its core, it's primarily a process issue, which means you have to address it early on.
You need to understand that data is generated within a process, and if the process is not properly set up, you end up with poor-quality data, incorrect data, or redundant data.
And that's exactly where AI can indeed help — to some extent — by supporting the sorting and processing of this data overload.

So yes, if someone says, "I can't use AI because I can't make use of my data,"
you could just as well say: "Then let's use AI to help manage and make better use of that data."

Handling large volumes of data — purely in terms of storage space and how it is organized — is also a task that falls to IT departments, in collaboration with their suppliers.
If you have a good working relationship between those departments, it tends to function well.
So yes, data is definitely a relevant issue.

But I personally expect that AI methods could be helpful, especially from a technical perspective, in better evaluating the type and structure of the data.

Vincent Habitzreuther
Okay, I understand. One of the topics that also plays a role in my thesis is sustainability and global trade.
What do you think — how can AI support or optimize this topic?

Michael Kranz
Good. If we take a look at sustainability — yes, it's often about the waste of resources.
Whenever this topic is discussed, there are always various aspects to consider.
One of those aspects is resource waste.

For example, in supply chains during transportation, it's easy to see:
If I have delivery trips that are not fully utilized, or if vehicles are not optimally deployed, then that's a waste of resources.

AI could help here by ensuring better capacity utilization or more efficient route planning — which would already be a contribution to sustainability and optimization.

On the other hand, we must not forget that AI itself is a significant resource consumer.
It is extremely energy-intensive. That's why the whole DeepSeek story was so shocking to many people at the beginning — because it became clear just how much energy is required.

But maybe AI can also be operated more intelligently — that definitely needs to be validated.

Still, when it comes to sustainability in general, algorithmic or AI-based optimization can certainly help reduce the waste of resources.

Vincent Habitzreuther
Do you perhaps have a specific example that comes to mind?

Michael Kranz
What did we do? Well, when you look at it in detail, it's actually a very small example — I'm not even sure if it really counts as AI.

At the steel plant, raw materials were delivered via the Rhine. They came in inland barges, or rather in these large cargo containers, where coal and iron ore were transported.

And then the question was: Where exactly are they? How fast are they moving?
How can I optimize that?

So we equipped these containers with sensors that could transmit their position in real time via GPS.
That made it possible to optimize their speed — for example, if the harbor was full, they could slow down and, as a result, save fuel.

We were already addressing these kinds of issues back then.

Was it AI? Maybe not — maybe somewhat? At least we gathered the data.

And the exciting part was: what did we use as sensors?

We didn't install any expensive equipment.
We simply took old iPhones — placed one in the front, and one in the back.
That way, we could determine the exact location of the barge — whether it was moving north, south, east, or west.

So, using small, practical, and low-cost solutions, we were able to generate valuable insights.
That might serve as an example of how optimization can be achieved in a very concrete and applied way.

Vincent Habitzreuther
Very good, very good. Let's move on to the next point.
When it comes to regulation or ethics, AI is often met with skepticism.
Is everything functioning properly? How is data handled?
What's your take on this, especially in relation to supply chains?
Do you have a position on it? Or would you say: "We've already gained some experience in this area"?
That could be an interesting angle. How do you see it?

Michael Kranz
I wouldn't necessarily say we have concrete experience here, but when it comes to this topic, it's definitely worth taking a look at the EU AI Act — to understand what is actually regulated there.

There are, for example, specific requirements when it comes to the use of AI in critical infrastructure.
Or with AI deployment in areas like security and healthcare — where it directly affects or could endanger human lives.

This is where you really need to look closely.
And it's true that supply chains can also be considered part of critical infrastructure in certain areas.
Not in every single case — that would be overstating it — but in specific scenarios, yes, the regulation becomes relevant.

And when we talk about ethical issues, it's a similar situation.
For example, the use of social scoring systems is explicitly banned.

To bring this back to a practical example:
In many companies, there are company agreements in place that explicitly prohibit the use of IT systems for monitoring employee performance.
That means — for example — systems that track how often and how long someone has stared at a screen.
Sure, an AI might be able to evaluate that, but it's not permitted.

We're clearly in the realm of ethics there.
This doesn't apply only to supply chains, of course — it's a broader issue.

Still, for the context of supply chains, I'd say: it's absolutely worth taking a look at the EU AI

Act in relation to critical infrastructure.

Vincent Habitzreuther
Got it — cool, thanks.
Let's continue with the next topic: possible integration and future perspectives.

If you go into a consultation today and say: "Alright, we now have a project that also involves AI" —
What best practices would you recommend to make it a success?

Michael Kranz
The best practice is always the one you've already applied successfully.
So we actually like to use references — concrete examples where something has already been implemented.

Especially in the industrial sector or on the shop floor, we have a collaboration called the *Industrial Analytics Lab*.
There, we have some very interesting examples — not specifically in the supply chain, but more broadly in industrial production.
For instance, optimizing the driving behavior of machines based on data.

You can easily imagine applying similar concepts to transport routes and logistics processes.

So, this brings us back to what I said at the beginning:
What's always important is to make things transparent right from the start —
what you're doing, what data you're using, how it all fits together.

Of course, you can't explain every last detail.
When it comes to machine learning, you won't be able to break down the whole neural network architecture.
But you can at least say: What have I used? How did I do it?

And I always involve people right from the start.
I say: "Let's make this a joint project from the beginning."
Because going off into a dark little room with a task and reappearing six months later with a finished solution — that's definitely not a best practice.

Yes, I understand. So always involve people from the beginning.
Be transparent about what you're doing and let others work with you on it.

Take small steps — say: "Here, try this out."

That has always been a success factor in all of our projects —
whether with or without AI, whether in the supply chain or not.

Vincent Habitzreuther
Okay, I understand. Cool.
Now, in your opinion — and I know this is a more opinion-based question — how do you see

AI in terms of the competitive landscape?
Not just in supply chains, but in general, in the context of international developments?

Michael Kranz
As with any new technology, you have to strip away some of the hype and ask:
Where are the truly relevant use cases?
What can I actually do with them?

And who — whether it's a company, a company group, a country, or a network — is able to use the technology in a way that optimizes processes and creates a competitive advantage?
Whoever manages to do that is one step ahead.

So just like with any new technology, the key is using it meaningfully —
to actually create a business benefit from it.

It's not about saying, "We now have AI," but then nothing else changes.
That's not what it's about.

It's about actually achieving impact — like we discussed earlier:
fewer empty transports, lower fuel consumption — those kinds of things.
If I manage to implement that, then of course it creates a competitive edge.

So I would say yes — but exactly how, I can't predict.
I don't have a crystal ball in front of me.

So someone will take the lead — and then others will follow, step by step.
Yes, something will come.

How exactly? I might answer that differently in another context.
But I do believe that the geopolitical disruptions we're currently experiencing are having a greater impact on supply chains and global trade than the use of AI.

Vincent Habitzreuther
I see it the same way. Yes, not bad at all — absolutely.
Now maybe for the final question:
You've already touched on a few things, but are there any AI technologies where you'd say:
"These are definitely the ones driving the entire topic forward and having the greatest impact"?
And on the other hand — are there any where you'd say:
"They really don't make much sense"?
What's your take on that?

Michael Kranz
Well, there are a few things to list here — digital twins, predictive maintenance, RPA, and so on.
These are all technologies, but I wouldn't immediately classify digital twins as AI — you can also implement them independently or in combination with RPA, which is more of a traditional automation approach.

Machine learning leans more toward AI — including generative AI, such as large language

models.

Maybe one day even the good old “declared dead” blockchain will make a comeback.
I could imagine that.

It’s been discussed for a long time — especially in relation to self-organizing systems in supply chains.
What’s interesting is that there isn’t always a human in the loop anymore.
Sometimes, orders are automatically generated — also using AI.

Then the question is: how can I trace who commissioned what from whom?

This leads us to technologies that have been declared dead but are still active — like blockchain, especially under Bitcoin.
They’re not truly gone — so a combination of technologies for a specific use case might very well resurface.

And one more point to wrap it up:
I think we tend to use technology too one-dimensionally.
Everyone’s focused on optimization — the so-called “sunshine processes,” as I like to call them.

Everything runs smoothly, everything is streamlined — but what happens when things go wrong?
Like a supply chain disruption — as we saw massively during the pandemic.

So the real question is:
How can I increase the **resilience** of my supply chain?
How can I make it more robust against disruptions?

That could be a key application area for AI — forecasting disruptions, planning for uncertainties.
Yes — definitely an exciting time.

Vincent Habitzreuther
Yes, I think so too — absolutely. Great.
So, I believe that’s all the questions.
Do you have anything else you’d like to add?

Is there anything where you’d say:
“Wow, that’s really important — I definitely have to tell Winston about that”?
Or something else that comes to mind?

Michael Kranz
Let me take another look at the title of your work:
“Integrating AI in Supply. Implicación para la sostenibilidad y el comercio mundial.”

Okay, a bit of a hybrid — but I’m not really an expert in global trade.

Vincent Habitzreuther

No, of course not — that's why people try to interview individuals who can offer a different perspective.
And I found your insights really interesting, yes.

Michael Kranz
Exactly. I'm just checking my notes.
And I believe we've covered the essential points.

The questions were really just meant as a guide — to help structure the conversation, but they touched on all the key aspects.

Vincent Habitzreuther
Yes, right, right.

Michael Kranz
Very good — I'll ask my colleagues if anyone else might be interested.

Vincent Habitzreuther
Yes, absolutely — the more, the better, like I said.
You can just reach out.
I'll connect you if there's interest.

Michael Kranz
Alright — next email will come from me then.

Vincent Habitzreuther
Yes, good — perfect.
Very good.
When does it need to be finished?

Michael Kranz
Yes, sincerely — when is the deadline?

Vincent Habitzreuther
Oh, we have to submit it by the end of May — so there's still time.
The defense of the thesis will be at the end of June.

Michael Kranz
Excellent.
Would it be presumptuous to ask if I could have a copy?

Vincent Habitzreuther
No, not at all — of course!
I'll be happy to send it to you.

Michael Kranz
I'd honestly be interested to see how my input ended up being reflected.
Very gladly — thank you so much.

Vincent Habitzreuther

Yes, thank you too — many, many thanks.

Michael Kranz
All the best, and much success!

Vincent Habitzreuther
Same to you — take care, goodbye!

Michael Kranz
Thank you — goodbye!

9.5.3
Interview C

Vincent Habitzreuther
So, I kind of structured the questions into three different themes, and the first question would be that you maybe kindly give us an overview of who you are, what you've done, and what your experience is with supply chains, and maybe also with AI.

Sikko Zoer
Yeah, so let me give you a bit of background.
Most of my career has been in supply chain — I actually started my career there. Almost everything I've done professionally has been related to supply chain.

I initially started as a project manager, then moved to a Finnish company where I got involved in logistics.
I helped set up just-in-time systems with preferred supplier setups, etc.

Later, with that same Finnish company, I became involved in an SAP implementation. At one point, I even led the implementation — the second time, at least. The first attempt had failed, and the second attempt, which I led, was successful.

That success allowed me to transition into IT consultancy — first focusing on SAP consultancy and then business consultancy. I'm still SAP certified, by the way. Technically, I could go back and do it again.

Though, to be honest, every time someone finds out I'm SAP certified, they take away my SAP system access — because they're afraid I'll start configuring the damn thing!
But it's always been an interesting journey.

I've always worked as a consultant at the **interface between business and IT**, and that's probably also one of the key themes for today's discussion.
Because I strongly believe too many people look at technology as the **one thing** that will solve everything.
But technology alone is never the solution — that's something I learned from my time in IT consultancy.

After that, I worked for a French company, Lafarge — that's actually where I met your father, by the way.

We worked together there.

I started as IT Manager for the Benelux countries, and then I got involved in a project called Aetecia, which aimed to build an e-commerce platform for the roofing industry in Germany.

I also served as Director of Operations for a while and did some project management. Eventually, though, the plug was pulled — this was during the time of the "new economy" bubble.

There are actually a lot of **parallels** to what we're seeing today with AI:
Back then, everyone wanted to jump into e-commerce, even though no one really understood it, or what to do with it.
But everybody was convinced it was the future, so lots of money was poured into it.

And I feel like we're seeing the same dynamic now with AI .

So, I fully expect a **big crash** in AI within the next year or so — and then we'll get back up again.

The same thing happened at Lafarge — what we were trying to do in e-commerce was simply **way too early**.
We were ten years ahead of the curve.

So, after that failed, I moved into marketing — I was Division Marketing Manager for the roofing industry.
Then I transitioned into strategy, again at Lafarge, working in the Moving Division.

After that, I moved to Medtronic, where I spent 15 years of my career.

I started out as Manager in the Supply Chain department — specifically in planning.
Over time, my responsibilities grew.
At one point, I was responsible for all of **Customer Care and Supply Chain** for Medtronic in the EMEA region.

At the time, Medtronic was a $32 billion revenue company.
The scope I managed covered about $8–9 billion.
And I was quite successful in that role — we did a lot of transformation work, supported by technology (let's call it that).

That was also where we began experimenting with **early versions of AI**:
We implemented automated invoicing using optical recognition systems, and there was some light machine learning behind it.

Eventually, I became the **Global Leader for Supply Chain** at Medtronic — and later on, I also led the transformation of the **entire operations organization**.

During COVID, for example, historical demand data suddenly became useless for forecasting.
So we built a forecasting system that pulled from various external sources —
like hospital counts, infection rates, etc. —
and built an algorithm that could **predict future demand** based on those.

It was a great initiative — but it ultimately failed.

Why? Because with sophisticated forecasting systems, you have to combine ("stitch") what the algorithm tells you with what's actually happening in real life.
That stitching is always a challenge.
We couldn't make it work at the time.
Today, systems exist that can do it, but back then, it didn't work.

That experience made me double down and **invest heavily** in a new global department called **Insights and Analytics**.

I deliberately started the department with the word *"Insights"* in the title —
because the real goal was to turn the **terabytes of data** we had into *business value*.

In the end, I built up a team of 45+ people — data scientists, data engineers, etc. —
all focused on the same question:
How can we leverage the data?

That's also when we began our first **true AI efforts** — what I now call "traditional AI."

Today, when people say "AI," they mean **large language models (LLMs)**.
But LLMs are just **one part** of AI.

Most AI in **supply chain** — and what I've worked on — has roots in **Operations Research** from the 1980s.
Many of the algorithms already existed back then — we just didn't have the computing power to use them in daily business.

With **cloud computing**, that's changed.
Even smaller companies now have access to powerful infrastructure via the cloud.

So, those old algorithms — they're finally becoming usable.
And I started working with them back then, because I could already see their potential.

Then, in **May 2022**, I left the company and started working in consultancy —
first on my own, and then by founding two companies with some colleagues, **Quinn Consultancy** and **Supply Chain Companions** (a Swiss-based company)

With both, we focus on **bridging the gap between business strategy and supply chain strategy** —
and on **making that strategy actually work**.

Naturally, AI plays a big role in that too.

VINCENT HABITZREUTHER
How can that help companies—especially Supply Chain functions—become truly successful with the application of AI? That was a bit longer than planned, but a good overview of what I've done.
Yes, that's very good. I think the first two questions go hand in hand. I've followed Medtronic for a long time and know how large it is. What you're doing now seems to be at

the other end of the company size spectrum, right?
Yes, although with Supply Chain Companions—

ANONYMOUS B
—we do what we call advisory work. It's more of a mentoring and coaching approach for leaders and leadership teams, mostly targeting large corporates.
With Quinn, however, we work with companies that typically range from around 28 million to 50 million, up to four or five billion. So you could say those are more small to medium-sized businesses.

VINCENT HABITZREUTHER
Let's move to the second point—challenges and opportunities—which is also the title of the chapter. You already mentioned the issue of data, which has come up in all of my interviews so far.

ANONYMOUS B
Yes, the data issue is absolutely critical. It's not just about data availability, but also about quality and accuracy. A lot of people think a data cleansing exercise is enough to fix the problem—but it's not.
If companies want to work successfully with AI , they need to establish a comprehensive data management process that covers the entire organization. That includes a strategic perspective on what data is and how to manage it, a tactical level that addresses organizational structure, data governance, defining roles like data owners and data stewards, and finally, the operational processes that ensure continuous data care. Many forget this aspect. Everyone who complains about "data being the problem" should look in the mirror. They are often part of the issue. Nobody likes data management—it's not sexy. Typically, the people responsible are hidden away somewhere, not taken seriously. But it's one of the most crucial roles in a digital organization. At Medtronic, I intentionally named our department "Insights & Analytics"—but an essential part of it was data management. We made sure that aspect was never ignored.

Another key issue often overlooked when implementing technology, especially AI and business intelligence tools like Power BI, is that companies don't understand their own processes.

When we set up the Analytics & Insights Department at Medtronic, we never started by asking stakeholders which KPIs or reports they wanted. We began by mapping out the business process itself. Only then did we look at the data and what kind of reporting or dashboards could be built.

If you want to apply AI effectively, you need a deep understanding of your internal processes. Most companies simply don't know how their own processes work. They might have data—but without knowing what the underlying process looks like, how can you optimize anything?

And to be clear, Vincent, the same principle applies whether you're implementing an ERP system, an advanced planning tool, or BI software like Power BI or Cognos. AI is no exception—it faces the same challenge.

Beyond the data and the process, there's a third dimension: people. Do you have the right people in place? We face that issue even today. You need individuals who are open to AI.

There’s a lot of resistance in Europe—concerns about privacy, personal job security, and simply a fear of the unknown.

You need early adopters, people who are excited to explore new technology. And these individuals must also have a very specific profile: they must be willing to try new things, be open to failure, be structurally minded when it comes to data and processes, have a tech mindset—and crucially, strong business acumen.

This last point is essential, especially when using large language models. You can ask them anything, and they’ll always give an answer that *sounds* convincing. But if you don’t have the business expertise to critically evaluate that answer, you’ll end up making poor decisions.

So yes, besides data and process, the people side is equally important. And one last obstacle I’ll highlight is this: Do people truly understand what they’re talking about when they speak of AI? Because AI is much more than ChatGPT.

VINCENT HABITZREUTHER
Yes, if we assume that we can account for all those challenges in the implementation of AI, what do you think the benefits could be—especially regarding sustainability and global trade?

ANONYMOUS B
AI can be a powerful enabler in that context. First of all, it can make your supply chain network more visible and transparent. That helps identify where obstacles or inefficiencies exist in your end-to-end processes. And as we know, every inefficiency in a process typically leads to higher costs, unnecessary urgency, or even panic responses. Especially in supply chains, once delays start to affect your ability to ship products, it often results in last-minute or expedited shipments—which are generally more expensive and less sustainable.

From a sustainability standpoint, urgency leads to higher inventories. Higher inventories often mean more production "just in case," which can lead to waste. So that has an obvious sustainability impact. On the inbound side—everything coming from suppliers—any disconnect or lack of visibility leads to inefficiencies, which also negatively affect sustainability.

When we look at the broader sustainability picture—Scope 1, 2, and 3 emissions—there are already many tools that help optimize these aspects. AI can enhance that further by providing a complete end-to-end view of your carbon footprint. You can now perform scenario planning much more easily, answering questions like: "What happens if I change this part of the network?" or "What if I remove this node?"—and instantly understand the impact on the total footprint.

I see a lot of opportunities here.

When it comes to global and international trade, visibility is equally critical. The clearer your network, the smoother and more predictable your trade flows will be. And as I often say, sustainability and efficiency are two sides of the same coin. If you become more efficient, you're also more sustainable—assuming you're making the right decisions.

In terms of international trade, there's a subfield called "trade operations" that involves all the import/export regulatory processes. That area is incredibly data-heavy. Every product must be

classified under systems like the Global Harmonized System (GHS). Increasingly, you're also required to declare the raw materials contained in those products. There are import/export declarations to manage, financial transactions around customs, duties, and taxes—it's a lot.

This is where I see a huge role for AI, because much of this work is repetitive and rule-based. It's ideal for automation.

VINCENT HABITZREUTHER
You already touched on regulatory challenges—especially around GDPR. Are there any other regional specifics you see, outside of Germany and Europe?

ANONYMOUS B
Yes. I believe we're far too focused on regulation here in Europe, particularly when it comes to AI. A lot of it is driven by fear. And fear is never a good foundation for decision-making. When people are afraid, they create rules and regulations that slow down progress—even when that progress is unstoppable.

In Europe, we've taken a very defensive posture toward AI. We've become followers—and not even active followers, but passive ones. We're standing still while the rest of the world moves forward. If you speak with people in the US or China, they're continuing to push ahead without hesitation.

Instead of trying to stop or slow things down through excessive regulation, we should be more open-minded. That doesn't mean accepting everything blindly, but we're currently stuck in an extreme. We need to move more toward the center and be more open and accepting of AI.

Right now, we're missing out on a lot of opportunities. Data privacy concerns are holding us back. Just look at Japan—extremely strict. But Germany is also shooting itself in the foot with its privacy regulations. Even something like Google Maps is restricted. Seriously, what are we doing?

The Netherlands is not much better, and this trend extends across all of Europe. Meanwhile, look at Switzerland. Many big US tech firms like Google and Meta are setting up their European headquarters there—not for tax reasons, not because that's where all the talent is, but because Switzerland has more flexible data privacy laws. And since it's still located in the center of Europe, you can do what's restricted in Germany, France, Spain, or Italy—right from Switzerland—and roll it out across the EU.

So yes, I believe we're dramatically shooting ourselves in the foot.

Vincent Habitzreuther
Maybe to the third point: when you and your company go ahead and consult businesses nowadays—what best practices are some of the things that you consider?

ANONYMOUS B
I always say: start small, think big, scale fast. It means—again—AI is still largely unexplored territory. The fact that you're writing a thesis about AI and supply chain and its implications already shows how new and unknown it is. Companies need to start exploring what it actually means, learn from it, and just begin doing it. But start small. Identify a few business cases and

pick a small one, just to get started and to understand: what does it mean? How do I apply AI? What does it require in terms of data? What does it mean for my processes? What are the outcomes?

And just try. Sometimes you're successful, sometimes you fail—but don't treat failure as failure. Treat it as a learning opportunity. If you identify use cases that clearly have an impact and create business value, then you can start scaling them up.

That's something I discussed with your father yesterday, actually. He was absolutely right—once you start scaling, you need to build the organization around it. That's also why I said in the beginning: find those few people who have the boldness and courage to be part of this journey. Those are the ones who will help you scale it up quickly.

VINCENT HABITZREUTHER
Yeah, okay, then we've already kind of explored that.

ANONYMOUS B
But with Europe kind of falling behind because of so much regulation—what else do I think? How will the competitive landscape change in the future, if AI is successfully implemented across most supply chains?

Well, I think, like with any industrial revolution, those who are first and move the fastest will be the dominant players in the end. They will be the defining parties. What I see—and not just with AI, but in general—is that Europe is significantly behind. I expect that power will shift even more toward the U.S. and China. Who will win that race, I don't know. But the impact on society, the economy, our companies, and institutions will be significant.

Maybe there's a unique opportunity for Europe. The U.S. and China typically just go for it and figure things out as they move forward. Europe, on the other hand, tends to be more reflective. That could be an advantage—**if** we don't lose speed in the process. We need to ask ourselves: what is the societal impact? We know that many of today's jobs will no longer exist in five years. So what happens to those people? What future are we going to offer them?

This also applies to supply chain. If you automate import/export departments, what do you do with those people? Are you going to lay them off—or can you find other ways to use their capabilities? There probably are alternatives. And globally, not just in Europe but also in the U.S., we're heading toward major labor shortages. We should look at AI as a huge opportunity, especially in supply chain.

But to fully grasp that opportunity, companies—and especially supply chains—must ask themselves: what am I going to do with all the people working in my distribution centers once everything is automated with AI-powered robots? What role can they play? These are the types of questions we need to be asking now.

And those regions or countries—whether Europe, the U.S., or China—that both move fast and proactively address these implications, those are the ones who will ultimately win.

VINCENT HABITZREUTHER
Okay. And then for the last questions we have—you already spoke about large language models, right? What other, or maybe more advanced AI technologies, do you think will

accelerate developments in supply chains?

ANONYMOUS B
Well, my point is, we talk a lot about generative AI, these large language models and such. That's one part of AI. But you can't apply AI to everything you do in the supply chain. If you want to do forecasting, for example, yes, you can do it with AI, but in the end, you'll need sophisticated algorithms behind it. And with digital twins too—AI can help, but it's not the whole solution.

What I want to emphasize is that generative AI in particular will help drive acceptance of AI overall. So everything involving machine learning, deep learning—I'm not an expert in those technical details—but I strongly believe that generative AI will lower the barrier for people to engage with AI.

Now, if you look more broadly at the technology landscape, what I think will become really interesting is the **convergence** of technologies. Right now, you have applications that are strong in image recognition or generation, others in audio, and others again in language. But once we begin to combine all of these—and link them with robotics—we'll see a real leap forward. That's where I believe major breakthroughs are coming.

Especially in supply chains, that could have a massive impact. Imagine distribution centers where there are no human workers walking around anymore, everything is operated by robots. That's where we're headed.

And even though I'm not a full expert in operations research, I know that field has produced a ton of algorithms and models that haven't yet been applied at scale in supply chains. There's still a **huge opportunity** in that space.

VINCENT HABITZREUTHER
Got it. Sounds good. I'd hire you. If I were running a business—just saying!

ANONYMOUS B
If that's your next job, let me know! Sounds good.

VINCENT HABITZREUTHER
I think it was a really good discussion. And honestly, if you say you're not an expert—I don't think you need to be a tech nerd to understand what needs to be done. You don't have to be the coder to implement AI successfully.

ANONYMOUS B
Vincent, exactly—that's what I always say. People always focus so much on the technology. It was the same during the e-commerce wave—everyone thought it was all about tech. Yes, technology is at the core, it's the foundation. But to really build something sustainable and successful, it takes more.

You've probably heard the triad: people, process, technology. And for AI, it's the same. But I always add two more elements: **data** and **policies**. Data is becoming more and more important. And policies? Well, when you go through a transformation, you need to embed the changes into your organization in a way that makes them stick—that makes them **sustainable** in the long run.

And I’m not saying you need a huge rulebook or endless quality procedures. But you do need to set up a framework—especially in terms of **data governance**—that ensures you maintain what you’ve implemented. That’s what I mean when I talk about policies.

9.5.3

Interview D

Anonymous A:

Alright, very good.
Vincent Habitzreuther:
Yes. I see the recording is already running smoothly. I had included the questions in a meeting note — I don’t know if you saw it. These are the ones I’ve written down so far or thought of. Honestly, I’m not yet fully prepared. But since you said you're only available until tomorrow — are you coming back afterwards, or how does that look? We can also postpone to next week.
Anonymous A:
No, no — we can do it now. Just to note though, these aren't yet the most sophisticated questions.
Vincent Habitzreuther:
Understood.
Anonymous A:
By the way, I’d recommend always using the same set of questions. That way, you’ll get consistent answers.
Vincent Habitzreuther:
I will absolutely do that. This round is just preliminary.
Anonymous A:
That’s fine. Just a heads-up: Wednesday is my last workday. After that, I’ll be traveling until March 7th, and from the 10th — maybe the 12th or 13th — I should be available again. If you prefer, we can wait another two weeks.

Vincent Habitzreuther:
Well, I think we can go ahead and do it quietly. That’s already fine. The questions won’t change drastically anymore. So that’s good. Okay, when we do it now, I have you here — I can also just share my screen with you. I’m going to enlarge the view a bit. These are the things I’ve written down so far. I’m not sure if you had seen them before in the process or not?

Anonymous A:
Actually, I hadn’t seen that email — I had only received the appointment.

Vincent Habitzreuther:
Alright, no problem at all. You can take a quick look at it here. And then I usually proceed like this: I read the question out loud, for the transcript, to make sure it’s correct. And then

you just tell me what comes to your mind.

Anonymous A:
Sure, but just briefly again: how do you intend to publish this? Will it include names and company details?

Vincent Habitzreuther:
No, I report everything anonymously. You're basically anonymized already. It's categorized that way. I don't know — what's your current job title? Supply Chain Analyst or Manager?

Anonymous A:
Operations and Management Consultant — exactly.

Vincent Habitzreuther:
Perfect. Then I'll write it like that. And of course, your name will be anonymized. That's how I've handled it in my thesis so far. I've interviewed people across roles — whether analysts or managing directors — and everyone remains anonymous.

Anonymous A:
I've done the same. I only list position and industry.

Vincent Habitzreuther:
Yes, exactly.

Anonymous A:
And maybe also the size of the company or something along those lines. Just so people have a bit of context — it makes it a little clearer.

Vincent Habitzreuther:
Yes, absolutely. So, shall we get started? Let's begin with the first question. Could you briefly describe your role in your company?

Anonymous A:
Sure. I currently work as an Operations and Management Consultant at a small consulting boutique. There, we implement SCM projects — including those that involve regulatory complications. But of course, also all the topics related to procurement organizations and so on.

Vincent Habitzreuther:
Very good. So the question is predefined, but you can absolutely answer however it suits you best. The next one: what experience have you had with the application of AI in supply chains so far? Have there been any developments? What does it currently look like on your side?

Anonymous A:
What we've noticed is that the maturity of AI in supply chains is still quite low. In the projects we've worked on, we've mostly seen that many of them fail due to poor master data quality. So many companies have purchasing organizations and supply chains that are spread across five different data sources — and still, there's often no coherent or clean data quality.

You can, of course, start AI projects now and try to streamline processes, but it doesn't work

if you don’t have a unified data source. If you have five different supplier names within your organization, if there are duplicates, triplicates — those are the real challenges companies are facing.

There are already a few use cases for AI in supply chains. For us, the natural focus is on Supply Chain Risk Management. That means asking: How can I assess my suppliers? What risk characteristics do they have? In which countries do they primarily operate? In which industries are they active?

Take textile manufacturers, for example — they’re often based in Bangladesh, which raises issues around human rights and environmental protection. That would likely be a supplier with current or future risks. AI can help evaluate massive datasets in that context. A standard algorithm can do that too — but at some point, it reaches its limits. This is where self-learning AI algorithms can handle things a bit better.

However, we’re simply not there yet. At the current level of maturity, most companies are still assessing AI at a very basic stage. Few are truly leading.

We do have customers in the semiconductor industry, but even there, things are not much more advanced. Some companies are trying to get more visibility into deeper tiers of the supply chain — into tier 2, tier 3, or tier n — but the problem remains: How much information are suppliers actually willing to share? That’s a key issue many companies are struggling with.

Vincent Habitzreuther:
So you're saying the core problem is that many companies haven't even taken the first step — and yet they’re already trying to leap into the second?

Anonymous A:
Exactly. I recently spoke with a manager who also develops software products. He told me: “We’re building a Ferrari — a fully digital factory with a digital twin, completely automated.”

But the reality is: it’s not being applied, because the companies simply aren’t ready yet. People talk about building a Ferrari, but they’re still sitting in a Fiat Punto.

You first have to get the fundamentals right. And many are still working with Excel files or CSVs, shared somewhere in the depths of a server. These are the issues companies are still facing today.

Vincent Habitzreuther:
Okay, I understand. On to the next point. Which technological developments do you think have the biggest influence? Where do you see supply chains as being strongest? Is there something specific where you would say: “We use a lot of predictive maintenance,” or “We rely on machine learning” – something along those lines?

Anonymous A:
Yeah, I think the most promising one is predictive analytics. So, using historical data to determine a target scenario and then draw impact from it. But like I said earlier, it’s still very much in its infancy – at least from my current perspective.

Vincent Habitzreuther:
Okay, got it. Let's move to the next topic – challenges and opportunities. You already touched on this a bit, but what obstacles do you generally see in companies when it comes to implementing AI in supply chains?

Anonymous A:
A major issue is the lack of available data – or even just a proper data foundation – and also the lack of expertise. Many companies still treat IT as merely an administrative function. That means they don't really see IT as a strategic asset or potential value driver.
Building your own internal expertise is extremely costly. And building in-house solutions is expensive too. Relying solely on third-party software usually doesn't solve the problem either. Especially in the AI space, you often see vendors making big promises – mostly driven by sales teams – that the developers can't actually deliver on.

We've seen that many times: a new software provider shows up and says, "We'll fix your entire supply chain," but in the end, they don't. They can't. They're just boiling water like everyone else. That's a huge problem.

Vincent Habitzreuther:
Understood, that makes sense. So, the next point: What kind of potential do you see for AI when it comes to sustainability or global trade? Like a utopian scenario – what would it look like if it were implemented optimally?

Anonymous A:
If it were implemented optimally, all systems would communicate with each other and there'd be no need for human intervention. We'd have seamless communication across systems without manual involvement.

Right now, it's still like: you send an email, someone confirms it, then someone else enters the order into another system. Then you try to maintain the same data across three platforms. Every document gets uploaded five more times.

But if systems actually talked to each other, that whole human loop could be eliminated. Of course, you'd still want a human in the loop for oversight. But in an ideal world, all of that would be streamlined. Less friction, fewer delays – shipments would arrive on time more often.

Transport itself will still involve people, sure, but ideally there would be no more data silos. All systems would be interoperable, communicating at high speed, which would also improve load utilization. And that directly links to sustainability, of course.

But getting there will take a long time. The landscape is still very fragmented, and too many people are involved in these processes. So true harmonization is still far off.

Vincent Habitzreuther:
Sure, I can imagine. When it comes to regulatory or ethical challenges—especially in the field of AI—that's always a hot topic. How relevant has that been for you so far? What have you focused on? Or what were the main concerns from your clients where they said, "Okay, this is where things get tricky"?

Anonymous A:
One consistent issue is the training data. Where do you get it from, and how far are you willing to go with it? But honestly, we haven't reached that level yet. Supply Chain AI isn't at the point where you're, say, evaluating a candidate with sensitive personal characteristics like ethnicity or other ethical markers.

So, in that sense, the technology isn't yet mature enough to raise those kinds of ethical flags. That's why I'd say regulatory and ethical concerns in the supply chain space are still more of a back-burner issue. That's not to say they're unimportant—but it'll probably take a little more time before those become a central concern in our space. I'm not sure how your experience has been with AI in supply chains so far?

Vincent Habitzreuther:
Yeah, I'd agree with that. Maybe let's continue directly into the last section—strategic integration and future outlooks. Do you have any best practices or strategies that you usually recommend? Especially when it comes to successful AI integration in supply chains? Or even broader technology integration—what's the general approach you see working?

Anonymous A:
First and foremost, you need a clear requirements specification. Just like with any integration project: what does the customer actually want? What's the goal?

From there, you create a longlist of potential vendors that can meet those requirements. Then you evaluate them. That turns into a weighted shortlist. After that, you schedule demos, collect detailed profiles, evaluate the results, and begin narrowing it down. Once a vendor is selected, they present their solution, and you begin integration and training until it's fully embedded.

So, it's a funnel approach. You start with many, and you need to clearly define what that funnel looks like: What are you trying to achieve? What's the budget? What are your constraints?

That clarity up front is key. But the real problem, in my opinion, is that many people—especially at the managerial level—don't yet understand AI. Particularly managers who've been working with Excel for the last 20 years and don't have a sense of how far AI has come.

That initial funnel definition—the understanding of the goal—is absolutely the most important part. Everything after that is basic consulting. But really getting managers to grasp what's possible with AI? That's the hardest part. Once that clicks, the rest is manageable.

Vincent Habitzreuther:
Yes, I understand. So, in a sense, you need to bring everyone on board first before you can even begin?

Anonymous A:
Exactly. That's why we often start with workshops. We put everything out on cards at the beginning—what's important to you? What do you actually want to achieve? That's the most critical part.

Vincent Habitzreuther:

And do you usually have this expertise in-house, or do you need to bring in someone external—maybe an AI consultancy or something similar—to support the process?

Anonymous A:
Definitely. We're a boutique consultancy. Our strength is in the content, not the technology. That's our niche. I believe only large consulting firms can realistically cover everything under one roof—meaning both supply chain expertise and technical implementation. You also need a certain level of buying power to offer all of that to a customer in one package. Most companies will opt to collaborate with specialized partners instead.

Vincent Habitzreuther:
Understood. Now, moving to a bit more of a future-focused question: how do you think the competitive landscape will change through AI? Will many relationships shift? What will the market look like in the future?

Anonymous A:
I believe we'll see strong market consolidation. Right now, things are still very fragmented. But once things really start to move—once transport orders, for example, can be fully automated and processed instantly—it will accelerate rapidly.

It's a bit like what you see in the Gartner Hype Cycle. Once we hit that tipping point, developments will escalate. Yes, I absolutely think there will be major consolidation in the logistics market. I also expect transportation costs will drop significantly in the long term, just due to increased efficiency.

Right now, we still have so many friction losses across the board. But as systems become better integrated and automated, everything will become leaner and faster. Of course, that also means staffing needs will decline significantly.

That said, there are still a lot of "if" conditions that need to be resolved before this vision becomes reality. So yes, this is still more of a long-term projection—but one I believe in strongly.

Anonymous A:
Understand.

Vincent Habitzreuther:
Next, since we have already touched on it a bit—maybe overall in regard to technologies themselves—are there any categories where you would say they could be used now to build a bridge between today and the future? A slightly better adaptation of AI in supply chains?

Anonymous A:
So I believe, as I said, in the first stage, companies need to first clear the table so that their IT organization is cleanly structured. They need to know where things are, how things are set up—that everything is structured in a consistent way—so that AI systems can work with the data at all. Because if you have to navigate through this chaos as a human first, then AI has to be able to work with it much more efficiently, of course.

In the second stage, what I find incredibly important are Digital Twins. I think that's currently the highest-use case that can realistically be built. This means you can digitally represent all

broadcasts, all packages, each individual shipment. I can digitally represent the trucks, the production facility, to control all integrated parts together. I believe there's still a fairly high use case here.

But first phase: I get my organization together.
Second phase: I bring it into the digital world.

Because you see, the problem is that if things aren't digitally linked, then you always need a person who controls it. Someone still has to push the package from A to B, stick a barcode on it, or whatever. But if you can represent all of that digitally, then you've already gained a lot. And once everything is digitally available, there's still much more that becomes possible. You can get quite a lot out of it.

Vincent Habitzreuther:
And then you also initiate the next phase, so to speak. Exactly. Understood.

Anonymous A:
Yes. But those are the two basics you have to do first.

Vincent Habitzreuther:
Okay.

Anonymous A:
Good, good.

Vincent Habitzreuther:
One more question I have—do you have any other comments, anything that stood out to you in particular on the topic? Or in supply chains in general, where you'd say: Wow, this is currently the point where everyone says, "That's really important"? Or, "Here's where we have huge problems. This is influencing us because of what's happening globally"?

Anonymous A:
I think that the existing structures have become too complex for anyone to really understand how everything is interconnected. We have eight global carriers in the world that organize all container traffic. 80 percent of global trade flows via sea—and still, they don't have their product under control.

These carriers—there are ships that are completely overbooked, and you won't get any space on them at all. And then there are partly empty trips with these container ships. I believe that this remains a huge problem: maritime transportation is just poorly designed and very inefficient.

If the Suez Canal is suddenly blocked again, you have a huge problem. If the USA attacks the Panama Canal, you have a huge problem. We're still heavily dependent on maritime trade. And as long as the carriers don't get their operations under control, we'll continue to face major issues—especially in this area, even though it's actually the cheapest mode of transport.

If the Northeast Passage opens up due to climate change, reducing transport time significantly between Asia and Europe, I believe that will also become a major factor. But the maritime dependency remains a massive problem.

Another issue I see is the inconsistency of supply sources. If you're sourcing something from Azerbaijan, for instance, and there's a political shift from one day to the next—boom—you've got a problem. Suddenly you don't have the product anymore. That volatility, that uncertainty... I don't even know how to describe how it continues. The entire world has just become extremely complicated and complex.

And as an organization—even with 80,000 employees—trying to keep an overview is a massive challenge. It's incredibly difficult to break through all that with AI and bring clarity and structure. Sure, AI is cool. But of course, you'll also need to delegate competencies, and that's the trade-off. Let's see how we proceed from here.

Vincent Habitzreuther:
Understood.

Vincent Habitzreuther:
And regarding the overall topic of sustainability—do you think that if we reach a point where the entire supply chain can be significantly streamlined, say in the next five to ten years, that it will also significantly improve sustainability? Or do you think it won't make much of a difference?

Anonymous A:
I believe that efficiency always translates into sustainability. So when something becomes more efficient, it also becomes more sustainable. I see those two as closely linked.

I definitely believe supply chains will become significantly more efficient in the future—and, as a result, also more resource-efficient. And beyond AI, if we promote electromobility, if we have infrastructure—like conveyor belts—that connect cities, so you can just throw goods on them… there are already plenty of use cases for streamlining everything and making it more sustainable.

But the core problem remains—friction. There's still so much friction in the system, which makes it inefficient and very resource-intensive.

If we can do it better, it will automatically become more sustainable. I don't think the main goal is to become more sustainable—the goal is to become more efficient. And sustainability will follow naturally.

Vincent Habitzreuther:
Understood. That's a good summary. Yes.

Vincent Habitzreuther:
I think those would be all the questions. I don't know if you have anything else to add.

Anonymous A:
Yes, I believe things will escalate quickly once they get started. But the problem is, as I said earlier, that people are still living in a completely different world—especially in supply chains. You can easily optimize a digital product if you're working with, say, a banking tool or something similar. You can streamline it because it's already digital by nature.

But we're in the industry, in supply chain management, which is still largely analog. And you

have to reach the point where things become more and more digital.

I've learned one thing in this regard. I wrote my bachelor's thesis on RPA—Robotic Process Automation. And I took a very simple, basic process: a customer sending us transport orders via EDI. But all the transport documents still arrived by email. That meant we always needed a trainee to check the emails every morning. We had 100 orders per customer per week. That added up to 300 documents per week.

Each transport document had to be manually assigned to an individual shipment. So, we found the shipment in our transportation management system using the shipment reference in the email subject line. Then, based on the document type, we automatically uploaded the file with the correct reference to the shipment.

We've now done this for 11 customers. That entire project—my bachelor's thesis—took three months. It went really well and everything worked smoothly. But in the end, it was just a small project that made the process a bit more efficient.

What made it valuable was exactly that: it improved the process. And what my supervisor said to me was, "Baby steps." If you try to implement AI directly, you'll fail in supply chains. You have to take baby steps first, gradually improve things. Then you can begin to realize major efficiency gains. But you can't just come into the house swinging a sword. You have to do a bit of groundwork first.

Vincent Habitzreuther:
Yes, I understand. Cool. Sounds good. Top. I think I already have quite a bit of content together. That's not bad at all. What do you say?

9.5.5

Interview E

Vincent Habitzreuther
We'll do it in German, the questions, exactly. Okay, so for the first question: It's actually just a bit of a brief overview of yourself - what have you done so far, what are your career stages, your experiences or, above all, your experiences with regard to the topic of what Al in Supply Chain - or in German: supply chains - is.

Jan Behnke
Ok, yes, I'd love to. Well, I originally come from internal IT. I once did an IT apprenticeship at a large food company - in a group, I think, of around three and a half thousand employees. I then worked in various positions there and after ten years I moved into consulting, towards ERP consulting. I then made another switch back to internal IT and organization and have now been back in consulting for almost two years.
Exactly, I've already had a few points of contact with Al in the past, gained some experience and also used it in practice in some areas - both with customers and in companies where I

previously worked. Currently in consulting, especially in the area of supply chain management or supply chains, we are constantly being asked questions - especially when we organise presentations for interested parties, where they say: "Ok, what Al technologies and possibilities are there in D365?", i.e. in Microsoft's ERP - in the larger ERP, i.e. in D365 Finance & Supply Chain Management.
That's where the nice marketing slides are always unpacked regarding Al in the supply chain. However, we have not yet really introduced and utilised Al in practice in D365- outside of Sales. So there is always the question of when something is Al? If you look at where Al is used in Microsoft D365, for example, it is also said that this is Al technology in MRP runs - although it is actually nothing more than some logic that has already done the MRP runs in the past.
Now people are saying: "Ok, that's actually AI ", they're trying to label it
with the Al label somehow.
But exactly, that means that Al technologies have not yet been used in the supply chain- from personal experience with ERP and CRM in particular.

Vincent Habitzreuther
So everybody's talking about it, but they're not there yet - I'm just saying, right?

Jan Behnke

Not really in the supply chain yet, exactly. So there you have - so of course there are also statements from D365 where they say: "Okay, in the supply chain - how can I optimise the supply chain, how can I react to certain ERP events?"
But for me - at least that's what Dynamics D365 says Al is - it's actually already done that before.
In other words, if i now have any deviations from the supplier - no order confirmation or an order confirmation with a reduced quantity - or what effects does that have that my ERP system or MRP or MRP then also shows me:
"Okay, I have a shortage, and I suggest that you enquire about everything again with the other supplier."
Yes, that's the case. But it's already done that before.
Now it just does it again - that's the only difference now with Dynamics: they put it into an Al assistant.
In other words, the assistant basically tells you.
Before, there were just some masks that showed you this, and you could then act in the mask and say: "Okay, now we'll send another enquiry to this or that supplier."
And in the meantime, the customers who are using it have already said that they are still working precisely with the masks and not with the, let's say, Al assistant, which would then tell you what to do and you can then tell it promptly: "OK, then send out the requests."|
In other words, this assistant - especially in SCM - is not yet used
anywhere by our customers.
Vincent Habitzreuther
Okay, I see.
Question 1.2 actually goes a bit hand in hand with the first one, I would say - you've already more or less answered it.
In the meantime, what I always found really exciting in the other interviews I've done so far - they all had this as a topic across the board - was the topic of data.
And that brings me to question 2.1:
What major obstacles do you perhaps see yourself or do you also see at B4Dynamics when

it comes to implementing Al - especially in supply chains?
And perhaps you could elaborate on this.

jan Behnke
Yes, well, I currently see the obstacles to implementing Al in supply chains more in the fact that the benefit for the customer or for the company or for the user with the Al assistants is not yet given in any other way than with the possibilities that already existed before.
With all the MRP topics and screens, where it displayed the information to me - but, as I said, not as an assistant.
So, and the other thing is of course the topic of data.

Okay, sure - of course I can also use Al technology, but, as before, it can only be used sensibly if I have a certain amount of data and a certain quantity of data. And the data quality must of course also be appropriate so that I can...
But again, regardless of AI - whether it's some kind of, let's say, algorithms that show me something and point me to something, or an Al assistant that analyses the same data, perhaps even comes to the same results, but transmits it more as an assistant, let's say, in a different way and then gives me the option of the assistant being able to carry out and trigger certain activities directly - rather than the user having to do it manually.
But of course, the data is always important: the data quality, data access - and, of course, comprehensive data access.
Then, of course, there is the issue of data security and data protection.
With Al, of course, the question is: Which systems am I travelling in?
If I'm in my ERP world, of course, and I have my ERP data - where is it hosted?
And is this also cross-ERP data that it needs to access?
Yes, and so that I - I'll say - also have certain training effects with machine learning, it's often about cross-ERP topics.
And then, of course, bringing that together and merging it is incredibly difficult - if there are different data sources that I have to tap into and then, of course, I also have to try to harmonise the data so that it can be evaluated properly.
That is of course a very big challenge in this area, yes.

Vincent Habitzreuther
If you're advising someone now and talking about Al - it doesn't always have to be the main topic, it can just be a factor on the side - do you look at it, especially in terms of sustainability, maybe now in terms of supply chains, also global trade, international trade- how do you see Al contributing to the promotion there?

Jan Behnke
Yes, that's also crucial again - now also the whole issue of supply chain due diligence, which of course also affected customers.
That used to be a huge issue.
Then we also - I'll say at B4D - did a theoretical part where we commissioned a colleague to devote herself to this - to prepare what it means for our customers and how we can advise our customers on what options they have.
And I'll just say that in the technologies in which we operate - for us, that means in ERP, of course, because ERP is our core business, i.e. in Dynamics, i.e. in D365 Finance & Supply Chain Management.
And there are the topics - not yet as a ready-made solution or anything else, but of course there are smaller companies that have jumped on the bandwagon due to the announcements

and have tried to develop solutions in the Dynamics environment with add-
ons, so to speak.
But we are also noticing this: It's an issue - now we're also realising: okay, what's the next step?
There is also a great deal of uncertainty at the moment.
In other words, it has levelled off again.
At the moment, none of our customers are asking about it any more.
Yes, we had a phase - I'll say - three quarters of a year or a year ago when demand was pretty high.
Then we went there and basically made the same presentation with the possibilities and features that are available - in other words, what we can offer.
Yes, but nothing has happened since then.
But that will of course be crucial now - how things will continue, I'll say, in the area of sustainability with the regulatory requirements, yes.

Vincent Habitzreuther
Yes, you've already said it - to the next point, especially in terms of regulation or general challenges for the integration of Al.
Because - so often the statements from other interviewees - they say:
"Yeah, a bit of a shame."
Well, I've mostly spoken to people in the EU or especially in Germany, and they just say:
"The big problem we have is that we always regulate here first - and then we take care of innovation."
And in other regions of the world, such as the USA, but also in Asia - especially in China - the
whole thing is done the other way round:
They first look at what is possible, how we can do something innovative, and then they regulate.
How do you see that?

Jan Behnke
Yes, that's still a pretty big issue at the moment - regulating first and then developing something.
And of course that's incredibly difficult, because then you're left behind from the outset.
In other words, until we are ready to define what it could and should look like - and then wait for it to be defined - and only then for companies or other stakeholders to be willing to engage and invest in it, that is of course a hindrance.
Especially because we also know how long such processes take - until the regulators and the corresponding requirements are actually finalised.
And especially with transnational EU directives - that is of course always a lengthy process.
And that's - I agree - it's not without its problems in the field of Al. That's just the way it is.
Of course you have to say: Okay, the ethical challenges also have to be taken into account.
But the question is: at what point in time?
Do I start now and can then say: "Okay, but if I already have solutions and continue to work on Al technology and gain new insights, it will certainly be easier to say again: What do we
And if there are regulations afterwards, then yes, I'm still of the same opinion:
Co a certain extent, I can of course take this into account in existing solutions or similar - i ther words, exert influence and make adjustments
But just waiting for it to be regulated at some point and only then starting - that will always lead to us lagging behind a little.

That's just the way it is - at least in my opinion, yes.

Jan Behnke
So we currently - well, we're not specialised in Al.
Al is only ever a peripheral topic for us in relation to, let's say, the large ERP area
But that means we don't have any... Well, we do have our own data analytics team, which is let's say, a subsidiary of ours.
But it's more about, let's say, data preparation, visualisation - the whole topic of Bl - and less about data... So it's all about analysing and displaying with KPIs, KPI houses and other things.
But not in order to then start any actions based on this.
Because from the moment I visualise it, of course, the recipient - the user - is the one who has to say:
"Okay, what do I do now with the numbers that are displayed to me? Or with the graphs- what conclusion do I draw from them and what do I do with them now?"
As I said, the biggest challenge is that if I then have the data and it comes from different sources, I have to be able to process it accordingly.
So that I can not only display it, but also start certain actions and workflows and processes.

But we don't currently have a share in this - so no customers either.
The customers who think this way either have - let's say - their own data analytics team, who then build and design it together with an Al consultancy or a company or something else.
But we are really only involved, if at all, when it comes to which ERP data is really necessary there - so that it is then processed and presented in a data warehouse or something else, or the data is made available so that it can be analysed.
But we are basically just the, shall we say, data provider.
So: How do we get to the database?
How does the ERP data get to the database where it is needed?

Vincent Habitzreuther
Maybe following on from that - that actually fits quite well - that's a bit of a hypothetical now:
If you say you don't have Al as your main focus there - what best practices do you think should be considered if you want to successfully implement something like Al, but also other IT transformations in supply chains?
So you can let your imagination run wild and say: "Hey, that would be the optimal scenario- if that works, then the integration will work too."

Jan Behnke
Yes, I simply believe that the biggest challenge really lies in making the data available - in other words, all the data that is required.
And that's not just data that's in some systems or in the ERP system, but above all information, knowledge that's in some heads, in DMS systems or in files.
This means that the biggest challenge for companies is to first make the knowledge transparent - the knowledge that already exists in the company:
Be it in heads, be it in some filing cabinets, be it on some file servers, be it in some document management systems, be it in an ERP, CRM or something else.
You have to make sure that the data - i.e. all the information that a company has - is available so that I have the opportunity to use Al technology or similar to analyse this data

properly and draw the right conclusions from it.
And I think that's the biggest challenge.
The company has to look - well, in a company where I worked before, we always said:
"If RENA knew what RENA knows." - because that was the name of the company, RENA.
Because we had so much knowledge at RENA, in the RENA Group - even internationally, across national and continental borders.
But the knowledge was spread all over the place and there was no access to it because, as I said, it was either in filing cabinets, on file servers, in someone's head or somewhere else.

And for me, that's actually the crucial thing about the whole Al technology - especially for companies, especially in the supply chain:
That I have to make sure that the information that is available in the company is made accessible.
And that I can then evaluate this in order to be able to use the evaluated information to optimise the supply chain accordingly, yes.

Vincent Habitzreuther
If we look now at how maybe in the future - once this is all a bit further along than it is now how do you think the successful integration of Al, at least in most places, could change international trade?
Many have said that we will automatically become more sustainable because we will create more efficient processes.
What do you think is the way forward?
Jan Behnke
So what you can change with it? Or what potential there is in the future - also internationally?
Vincent Habitzreuther
Yes, that's right. So what does Al ultimately do for us - to put it bluntly? So what does it help us with?
Jan Behnke
Well, it should definitely help us to be able to meet the needs that a company has more quickly.
Accordingly, it should also help the companies themselves to be able to deliver more quickly.
Yes, because I'm not just covering requirements that may exist at a certain point in time, but also recognise future requirements - on the basis of, let's say, historical data or something else.
vhich enables me to ensure that a company no longer just reacts
but can act directly because the information enables me to do sc
That I can meet my needs with Al technologies,
without having to trigger the need as such individually.
In other words, I have - with all the information, with future orders or other demand triggers
already in circulation without having to wait for the order to be placed.
And the same applies to my suppliers, of course.
There, too, it should mean that we have significantly shorter delivery times throughout the

entire supply chain - and then also internationally accordingly.
and then internationally accordingly.

Vincent Habitzreuther
Mhm. On the last point: What Al technologies are there that will have a significant impact on supply chains?
Do you somehow have a cluster where you say: These are perhaps important for us, perhaps for IT consulting or the IT process landscape in general - others perhaps less important?
I've mentioned a few here that you can take - but they don't have to be those, they can also be other things that lie deeper, such as large language models in general, for example.

Jan Behnke
Mhm, so internally we're actually going in a slightly different direction.
We are currently building an assistant - a bot - with Copilot Studio to support our consultants in their daily work.
The aim is to make knowledge about the products and everything we use accessible.
You can then send simple forms and the bot not only accesses the Microsoft documentation relating to Dynamics 365, but also the documentation for our partner products.
We have also integrated our own document management system and our own DevOps concepts and developments.
The bot can tap into all of this as a data source.
In this way, we want to enable our consultants to respond to customer requirements as appropriately as possible - in other words:
"What are the best ways to implement these requirements in our D365 world and with our partner products?"
This is an approach that we are currently pursuing internally - and we are already doing quite well.
The same example applies to a former work colleague of mine.
He started his own business in the Al world - with an Al legal bot.
He's a corporate lawyer and said to me: "Jan, I think that 80-90% of what I do every day- for my customers, my clients, for the companies I'm responsible for - can actually be done by an Al bot."
And they are already very advanced in this respect. The whole thing runs in a private cloud, of course - data protection is a big issue.
But i can see huge benefits for companies that could use a legal bot like this.
I also see potential in the area of predictive maintenance.
We had that at RENA, for example - they build machines and systems.
At the time, we wanted the systems that RENA manufactures for customers to be used in such a way that they lead to less downtime.
But we realised - especially in Asia, where the majority of our systems were sold - that customers didn't want that at all.
They don't want the machine they buy to send out data - because this is a huge issue for them in terms of protecting their expertise.
In the semiconductor sector, the machines are fine-tuned to deliver particularly high output.
And customers don't want parameters or other machine data to be passed on - not even to the manufacturer,
because they are afraid that the competition will gain access to this information at some point.
In the high-tech sector in particular, you quickly realise that data security and know-how protection represent a major hurdle.
Otherwise, what we currently use most frequently with our customers is Al in the area of incoming invoice scanning and in the incoming document process in general.

We actually use this in all projects:
A digital solution with Al technology that results in incoming invoices being scanned automatically - regardless of the transmission method.
And then the entire posting process - including account assignment, different VAT rates, etc. - runs automatically.
The whole process is then controlled via a workflow and a release system.
This is the area where we realise:
It's tangible, understandable and also easier to "sell" to our customers.
And that, I think, is generally crucial with Al - at least in my opinion:
If you want to get started with Al at companies, you shouldn't try to implement the biggest solution straight away,
but start with simple, clear and tangible use cases.
One example: an Al legal bot - I don't have to explain it to a company.
They know immediately what it does.
It's tangible for them because they have to deal with legal enquiries - e.g. about terms and conditions or other legal checks - on a daily basis.
The hurdle to actually using Al technology is much lower.

9.5.6

Interview F

Vincent Habitzreuther
So, let's get started. I'll share the questions with you. Do you see my screen?
Yes. Exactly.

So, have you looked at the first question, or do you know what it's about?
Exactly. And the first question would be: could you tell us a little bit about yourself — what you've done so far, where you've been, what has shaped you.
And in that context, perhaps also directly address the overarching question of how you're connected to the topic, or what knowledge and experience you've had with it in the past.

Astrid Rothaut
With pleasure. I have a background in business administration. I originally studied Business Administration in England and Germany — it was a dual-degree program. Back then, it was still the combination of a Bachelor's degree and a Diploma in Business Administration.

During my internship in South Africa, I started working with SAP — specifically with the SD (Sales and Distribution) module — and gradually moved more into IT.

I've since carried out several relevant projects and been active in a wide range of industries.
In my last two roles — currently at Brunata and previously at IMI — I've had full responsibility for IT.
That means I wasn't only working in project management or within the logistics module anymore, but I was responsible for the entire IT landscape, which of course supports the full process architecture of these companies.

AI has not played nearly the role in the past that it does today.
From my point of view, it's also important to say that AI is really more of a buzzword.

Many of the concepts already existed — just under different names — particularly in supply chains.

In recent years, there have been many exciting startups working in logistics and supply chains, especially around the coordination of logistics processes.
The aim was often to simplify these processes, make them more accessible or comparable.

Logistics — as I know from my best friend, who has shipped slag buckets — can be incredibly difficult to understand at times.
And when prices fluctuate, you often can't say exactly why.

During the COVID crisis, there were massive disruptions.
We noticed this very clearly at IMI — for example, when a container just didn't arrive where we needed it, because everything had suddenly been rerouted to the U.S.
Or because the Panama Canal was blocked — or, or, or.

So the broader topic — intelligence through data collection, data availability — is something I've had a lot to do with in the past.
The current hype around AI or AI is something quite different now.

Vincent Habitzreuther
So, AI is kind of what sits on top of the processes and technologies that already existed? Something that now serves to promote and enhance all of that?

Astrid Rothaut
Exactly. That's why when I see these so-called "new" AI technologies, I'm often skeptical. Because honestly, most of these things already existed, still exist, and often have nothing to do with AI in the strict sense — or at most are precursors to it.

Take the digital twin in production, for example.
I was already talking about that in the early 2010s — and yes, back then it was extremely expensive.

But we saw it being used — in Aachen at RWTH, for instance — when small electric vehicles were being developed.
They were working intensively with those kinds of technologies.
They had almost fully automated production systems.

Predictive maintenance is another topic that's been on companies' minds for years.
The infrastructure is already there — sensors, monitoring — it's just that many companies shy away from the cost.

And what companies often forget — and I say this from personal experience — is that they say, "Oh, but that's not AI, right?"
Well, how should AI know anything if you don't have the data?

As always, and I'll go back to basics here: garbage in, garbage out.
If you have bad data, you get bad results.

And to be honest, I have yet to encounter a company that truly has clean, structured, well-

organized data —
and I've seen many companies that are otherwise very competent and aware of how important this is.

Only when the data is clean — not duplicated, not ambiguous, clearly categorized — can you truly achieve impressive results with AI.

As for RPA — Robotic Process Automation — placing an order or automating such processes:
We were already doing that at NKT back in 2015 or 2016.

So, these are not new topics to me.
These are themes that have always emerged as part of automation.
And today's AI is simply the next level — an additional layer of automation and algorithms.

Bring it to the forefront again — sure.
But a chatbot just predicts what I want, and yes, the algorithm is pretty good.

And I'll also explain why I'm so critical:
We once had a presentation — I believe it was from the AI Center NRW or something like that —
and they showed us eight pictures.

Four of them showed wolves, four showed huskies.
The AI identified the husky as a wolf.

As a human, it's obvious: that's a husky. But why did the AI make the wrong call?

Well, in the four wolf pictures, there was snow in the background.
In three of the husky pictures, there was no snow.
Only in the fourth husky picture was there snow.

So the AI read the white background and said: "Ah — lots of white — must be a wolf."

That's the kind of thing you have to be aware of.
AI doesn't *think*.
It's an algorithm. It's math.

And that's something people love to forget.
That's when AI is used incorrectly — or people expect miracles that it simply can't deliver.

Vincent Habitzreuther
When you say that AI is used incorrectly — also in relation to the topic of data — you've now said that you've looked into this across many different companies.

That leads me to another question:
Would you say there are differences between certain companies — for example, SAP, Accenture, or Strategy&?
Could some of them handle data better than others?
Or were the companies you worked with rather different in their approach — maybe some

doing completely different things, but still better?

Astrid Rothaut
That's a really good question.
I believe the classic consultancies — yes, they give advice.
They tell a company what would be good **if** they were to implement it.
But in the end, implementation is always the responsibility of the companies themselves.

SAP, for example — and this goes back a few years — used to say:
"If SAP knew what SAP knows, we would be much better and more efficient."
I think that still applies today, at least in parts.

Even now, when I speak to friends who still work there, I hear feedback that they've improved a lot.
They nurture internal know-how differently now and thus also have different access to their own data.

In my case, I'm typically dealing with data in companies like food manufacturers.
They have recipes, similar to the pharmaceutical or chemical industries.

So in the end, there's a product, and there are formulas or recipes that go into it.
But if you have multiple company locations — perhaps even abroad — then each subsidiary might use different names, identifiers, or article numbers for the exact same intermediate product.

That leads to misunderstandings.

From my personal experience, I know this too:
France and Germany can have the same customers, and still, there's debate about who the *main* customer is.

And then, we get into sales figures.
Every company has different reporting standards, KPIs, and payment terms.

Then someone says:
"These are now the payment terms for both countries."
But then you get stuck in this eternal back-and-forth, and the result is an unreliable database.

Because if I ask: "What are our payment terms, company-wide?"
Do I mean France? Or Germany?
Or should we maybe go with Greece's terms instead?

And someone will say:
"Well, in Italy they're even better — maybe that's why this customer always shops in Italy and not in France."

These are all things you can only recognize if you *look* at your data.

But for that, you also need to be willing to admit your own mistakes and weaknesses.
And that is often difficult.

In my experience, this is usually easier in **owner-managed** companies than in major corporations listed on a stock exchange.

Because if I, as a board member, have a quarterly or annual target — I don't want to hear that our database is flawed or that we need five years to clean it up.
I don't think in five-year timelines.

But a family-owned business is much more likely to say:
"Okay, this is our current state — let's define medium- to long-term goals, break them down into steps, and implement them."

This isn't a general rule, of course.
There are large companies like Nestlé that recognized the importance of clean data early on and started working systematically to harmonize it.

But there are also owner-managed companies where the boss simply doesn't want to hear he ever made a mistake — because he believes he's infallible.

So all of this is just from my personal experience.
It's not universally true.

Each company has to be looked at individually —
and we have to assess how willing they are to **learn**.

Vincent Habitzreuther
Yes, absolutely — I understand.

Maybe we can directly link this to the second question — 2.1 —
What obstacles do you see?

You've already hinted that data is a major issue.
But are there other aspects where you'd say:
"These are the kinds of things that might prevent successful AI implementation now — or in the future?"

Astrid Rothaut
Yes, absolutely.

When you're looking at an entire supply chain, you've got different competitors involved — and that makes integration difficult.
You can see this clearly in the automotive industry.

There, you often have deep integration — sometimes the parts supplier even operates on-site, because that speeds things up.

But that also creates dependency. And it can be quite significant.

In contrast, in open markets, there's usually a lot of competition.
And companies don't like revealing too much — they're reluctant to show their hand.

This is where **standards** come into play — and even **antitrust** concerns.
There's always a lot to clarify at an organizational level.

Think of DIN standards, for instance.
I believe there's currently a mismatch between Italy, Germany, and Austria — regarding train systems. The track widths are different.

That means we don't have one standard train that fits on all tracks — instead, you'd need different trains for each country.

Sure, you could invent a new train that adjusts to different track widths — but it's not that simple.

Then the question becomes:
Is it worth it for the manufacturer to develop such a train at all?
Or would it make more sense to push for **unified standards**?

USB-C at Apple is another example.
Apple resisted for a long time — but now they're required to implement it.
So that's another case where the topic continues.

The implementation of AI — and similarly the **harmonization of data standards** — is constantly being slowed down.

Because companies often get in their own way.

And sometimes, there isn't even a real desire to optimize things.
Because, generally speaking, **lack of transparency is advantageous** — at least from the perspective of many market participants.

And *that* is why transparency is so often lacking.

Vincent Habitzreuther
I see. Fascinating. That's wild.

Astrid Rothaut
And when we move to point 2.2, the question becomes:
To what extent can AI — whether through automation, sustainability, or optimization — actually contribute to global international trade?

These are exactly the kinds of questions we need to ask.

Yes, I can of course work with AI and automation to make certain things more transparent. But in the end, it's still up to the companies themselves to actually implement and realize these possibilities.

Let's take optimization, for example.
If I'm working in logistics — especially in the supply chain — containerization was a huge leap forward.
And I honestly don't know whether AI will ever do something as revolutionary again.

But what AI *can* help with is planning — for example, identifying the ideal time to order a container, based on when prices are lowest.

If I have products that I regularly ship, I can use AI to monitor market trends.
How have prices evolved over the past year?
That data is usually available — and from there, I can try to predict when the most favorable booking time for my containers might be.

But that's where the challenge comes in.
We all know this problem from Google Maps:

The more people use it to avoid traffic jams, the more they create congestion on the alternative route.

So, the advantage you gain by using AI may only be short-lived.
Because if other companies are using AI too — and if they all target the same containers at the same times — then prices will rise again.

The advantage, therefore, is in **recognizing these curves early**.
And yes, AI helps make that much faster and easier to analyze.

If the system has the right parameters, it can track exactly what it needs to and draw smart conclusions.

And if each company uses different parameters,
then of course, they'll reach different decisions —
possibly identifying *different optimal shipping times* —
depending on what's most cost-effective for them.

Vincent Habitzreuther
Understood — okay.
That already touches on some of the challenges.

Is there currently anything major happening in terms of regulation — a big issue?
What's your perspective on that?

Astrid Rothaut
Regulation is very clear in Europe — not just in Germany.
We have the GDPR — the General Data Protection Regulation — or DSGVO in German.
Then there's also compliance and data security.

In practice, I've often seen this:
When you start working with AI in a company, people are excited.
There's a lot of enthusiasm and curiosity.

Especially in smaller teams, you see things like Microsoft CoPilot, or ChatGPT —
and people are amazed at how quickly they can generate results.
And suddenly, they realize: "Wow, I can do this!"

But what you really need is a **clear framework** —

one that doesn't shut down innovation, but still defines what is and isn't allowed.

There are real-world cases — I'll phrase it as hypothetical, since I saw it on LinkedIn:
People at DeepL once entered an entire **contract** for a large German company just to quickly translate it — and it ended up on the internet.
Why?
Because it was used as training data.

That's why I always tell my team:
Give people the ability to **work securely with data**.

ChatGPT offers business and team licenses — so you can ensure that whatever data is entered stays private and isn't used for further training.
That's important.

At the same time, I also have to be **very clear at the organizational level**:
Which types of data can be entered?
Which cannot?
What is absolutely prohibited?

It's not always easy to enforce technologically — but it *is* possible.
You just have to manage it carefully — and it can be very well organized.

Vincent Habitzreuther
Yes — at KPMG, for example, we had a tool like that.
You could upload an entire presentation, and it would automatically translate the entire document.

That was amazing.
You didn't have to re-enter everything manually —
no more copy-paste between windows ten times a minute.
That was a real game-changer.

Astrid Rothaut
That's great. And if we develop an application like that internally, I'd say: if we keep it in-house, then it's perfect.
You just have to build the right technological foundation for it.

We did that at Brunata — it was about testing user stories for an SAP project.
My colleagues, my team — we developed a small application. Nothing huge, but it took some time.

The tool allows someone to qualitatively review user stories based on the specs —
and the system keeps learning.

This was also part of our internal team solution.
The data stays with us — it doesn't leave the company — and that makes us feel secure.

We don't want other providers in the market — and there aren't that many —
to be able to see how we design our SAP processes.

That wouldn’t be ideal.

Vincent Habitzreuther
Understood. Yes, that makes total sense.

Shall we move on to the next question?
It’s about **best practices**.

What does that look like in your case?
If you were to say: “I’m implementing this now as Head of IT” —
what should we really pay attention to?

Astrid Rothaut
Yes — best practices are something that are still evolving within AI.

But in general, anything that involves my internal data **must stay internal**.
That means I can’t just casually operate using cloud services.

I really have to think carefully beforehand:
What do I want to achieve — and why?

That’s the real challenge — how do I gain the benefit on one hand, without giving up too much value on the other?
And more than that — how do I protect my data without neutralizing the advantage of using AI in the first place?

From my perspective, AI is already used in many areas.
Take **automated invoice processing**, for example.

We’ve been using that for about a year and a half now.
And the system — the automation or AI, even though it wasn’t called AI at the time — recognizes invoices based on predefined fields.

Over time, it learned to automatically recognize recurring bills.
“This invoice again, that invoice again.”
And it automatically sorts and files them.

At the beginning, the department had more effort, because it had to learn how the application works — and I had to support that a bit.
But now, it runs almost entirely on its own.

Only in special cases does anything need to be manually corrected or reviewed.
And that, for me, is a clear **best practice**.

You teach the system what it needs — no matter what you call it.
That’s what your company needs.

And this reminds me of something: Salesforce, for example, offers prebuilt “AI packages.”

I was once in a discussion where someone asked,
“Can’t you just deliver that to me pre-trained?”

We all looked at each other in confusion.
How is that supposed to work?

Only **you** know what your company needs.
Only **you** can train that system.

How is Salesforce supposed to give you a custom-trained AI package?
This learning must **always** take place within your company.

In the end, the **quality of the outcome** always becomes part of your company’s unique history.
That’s your responsibility — and I find that extremely important.

No one should think:
“I’ll just buy an AI, and it’ll take care of everything.”
You still have to take ownership.

That applies to everything.
And if you do, then the rest will work a lot better.
But not on its own.

And one more thing — **best practice is to clean up your data before you even get started**.

Vincent Habitzreuther
Yes, yes. You mentioned earlier that container standards were such a revolutionary step in logistics.

Do you think AI has the same potential — to implement something equally groundbreaking?
Or perhaps to help enable such a leap again — something that shakes up the whole system?

Astrid Rothaut
Not in the short term.
But yes, it **has potential** — especially for **optimization**.

It’s more of a continuous optimization process.
Which means: maybe it won’t feel as dramatic.
But it will lead to gradual improvements — like **more efficient supply chains**.

That could also mean:
Fewer ships, fewer empty trips —
which is absolutely necessary.

And sometimes it might make **costs more transparent** —
so that not just anyone, anywhere, in any country, can manipulate pricing unexpectedly.

But as soon as a country resists and says:
“It’s more expensive for us now, and we don’t like it,” —

the whole concept is disrupted again.

Because the **uniformity of the data** is no longer guaranteed.

And as containerization **relies heavily on global standardization and scalability**,
the same will be true here:

As long as we **don't have standardized data globally**,
it will be difficult to uncover and unlock the same level of potential that containers once offered.

Vincent Habitzreuther
Yes, I think so too. Maybe it's something we can't even imagine yet.
At least I've thought about it — yes, it's possible.

Astrid Rothaut
There's still so much potential for improvement.
We're basically seeing new developments every week —
so nothing can be ruled out.

Sure, it may not be a "Big Bang" — but remember, containerization wasn't initially seen as a Big Bang either.

People laughed at the idea, until suddenly it took off — and now it's the global standard.
It's the same with AI: everything is possible.

We might have options and directions that we simply can't see yet with today's standards — but that will continue to develop over the coming years.

And honestly, I would **love** to be proven wrong:
To suddenly see international **data standards** emerge —
that everyone agrees on and adheres to.

Vincent Habitzreuther
Yes, absolutely — I totally understand.
Cool, okay.

So, on to the final question:
You already mentioned a few interesting things.

Of course, not everything is purely AI — but the technologies you talked about are essentially the **foundation** on which AI is built.

That means even when we're talking about Machine Learning, Generative AI, or Predictive Maintenance —
these are the **underlying layers**.

AI is then built **on top** of that to make it all work —
at least that's what the literature says.

So now I’m curious:
What do you think?
How do you see things developing in the future?

Which **new technologies** might emerge?
What would you add to what we've already talked about?

Astrid Rothaut
When it comes to new technologies, I don’t even need to ask our dev teams — they’re already closer to it than I am.

What I *do* know is that **General AI** — artificial general intelligence — is a huge topic.

The idea that a system could eventually be smarter than humans?
Honestly, I haven’t seen anyone who is.

We’re still struggling with many aspects, including neural networks.

And to be frank — if we ever have an AI that’s truly more intelligent than humans, then I think we’re heading for a dystopia.
I’m more on that end of the spectrum, to be honest.

But when it comes to **automation**, and **algorithms**, yes — we’ll continue to see progress.
Processes will simplify. It’ll become more efficient and more affordable.

One area I find especially interesting is **sustainability**.

And looking ahead at **supply chain management**, I believe companies will start optimizing in small ways first.

For example:
When is the cheapest time to rent certain equipment?
Or when is the best time to schedule a shipment?

Ideally, we’ll be able to **optimize the entire supply chain** —
reduce unnecessary runs, reduce risks during transport, and improve coordination overall.

There was an excellent article years ago in an English magazine:
It explained how supply chains are becoming more fragmented.

Previously, you might have had one supplier covering the whole U.S.,
and then a shipping route to Germany.

Now, you might have **five smaller suppliers** in the U.S.,
and then several different chain segments connecting to Europe.

So yes, the coordination is becoming more complex.

AI can help us **level this out**, simplify things —
but it’s not going to become “easy.”

There will still be disruptions.

But I hope AI will help **minimize** those breaks.

Vincent Habitzreuther
So in essence, it's about **re-simplifying** the systems that have become overly complex in recent decades.

Astrid Rothaut
Exactly.
And if even a **small part** of that ends up benefiting the consumer — that would be amazing.

But that's a whole separate discussion.

Because when I think about it —
do we really need things like Temu or Shein and all the disposable clothing?

No.
We don't need that.

That's not an AI issue —
that's a **sustainability** issue.

Vincent Habitzreuther
Yes, exactly — we'll get into that right after we stop recording.

Right. So, that's actually all the questions.
The interviews usually last between 20 and 30 minutes, and I think this was really great input.

Thanks so much again.

Astrid Rothaut
My pleasure. Really.

Vincent Habitzreuther
Great — I'll stop the recording now, and we can chat a bit more off the record.

You said you really liked Dublin and went there on vacation, right?

Astrid Rothaut
Yes, exactly!

9.5.7

Interview G

Anonymous B

There to help us and guide us, and if you, uh, say, well, we don't have to 100% stick to them, you can just, okay, go around them a bit if you don't have anything that you're like, “Oh yes, this is maybe super accurate,” but maybe have something which is much more interesting. If it goes a bit off-topic, you're still very welcome.

Vincent Habitzreuther

How are you going to structure it? So you go more for subjective takeaways, not statistical type of—

Anonymous B
Yes, yes, it's a qualitative study, and the data collection is done by conducting interviews with people like you, basically—experts—and others from the industry who have knowledge on the topic. And yeah, with them I'm going to have interviews and then code the data, basically. So that’s why you need kind of a structure for the questions, right? But that’s how it’s called—it’s called semi-structured interviews. So we have a bit of a structure with the questions, but if we don’t 100% stick to it, that’s not a problem at all. Just extend whatever you want to discuss.
VINCENT HABITZREUTHER
Yeah, understood. I know. But already I think it’s pretty well structured. Okay then, yes—if you want to, I’ll gladly go ahead, yes, about my professional career.
To call it IT now, we call it digital data and IT because, you know, 15 years ago it was about having your ERP, your CRM, and maybe some basic reporting. A lot was still done with Excel, and sometimes even on paper. As the digitalization wave came, and the variety of applications we could use in enterprise also grew, so did the integrations. I think the evolution of the IT landscape is really exponential, and in the last 15 years, a lot has changed.

I mean, I’m talking mostly about big enterprises because this is where my experience lies. I started at Danone in Romania, covering the Southeast Europe hub—so covering the needs of multiple countries. Then I worked in consulting on supply chain processes as well as implementing ERP systems and things like that.

Then I moved to Germany, because as a consultant I had a project with Merck KGaA. That was already quite some years ago. And for the last 11 years—on April 1st it will be 11 years—I’ve had a career at Merck.

We have three different business sectors: one called Life Science, one called Electronics, and one called Healthcare. They are quite different businesses, especially when it comes to supply chain. So among my answers I might take different examples—let’s see how it goes. Also, just so you understand, it will cover more or less three different types of industries. Or if you want, I can also focus on healthcare, which is where I am today—so that’s biopharmaceuticals.
ANONYMOUS B
I mean, whatever you can connect basically works. Yeah. So you’re free to—okay. As you wish.
VINCENT HABITZREUTHER
I just mentioned that in case it matters if you want to say, “Okay, this is healthcare, this is life science, this is semi.” When I say “electronics,” I’m referring mostly to materials for the semiconductor industry.
ANONYMOUS B

Got it.

VINCENT HABITZREUTHER

Okay, so yeah, I also have the consulting mindset, but the majority of my career has been with Merck. Let's say two-thirds in supply chain and one-third in commercial—marketing and sales, so more commercial-oriented.

And when I say supply chain, I'm really referring mostly to the logistical side and warehousing, not to manufacturing and quality—although I have knowledge there too. I might touch on smart manufacturing when I answer the questions. I mean, you can also check my LinkedIn profile—yes, not everything is documented there, but it gives a bit of a glimpse.

So, AI and supply chains—when you think of a supply chain, it used to be very fragmented and built bit by bit, and not so much predictive, right? If something would happen, it was very difficult to find a workaround.

You have examples in recent years—right? The Suez Canal, various crises, the war—these events had a tremendous impact on companies like Merck and many others. And of course, AI cannot help you eliminate the impact of such events completely. But it can help you build scenarios very quickly.

I can give you more of a flavor. For me, supply chain is a lot about the planning side of things, and that really goes from: Who are your suppliers? Where are your materials coming from? To: When does a customer request an order—say, in Australia?

So, for me, the highest impact of AI is really in supporting supply chain planning. It's quite an endeavor. Because as I said, in the past 15 years a lot has happened—there's been great evolution—but still not enough. Not to a level where it's plug-and-play.

You need data. Very good quality data. And until recently, there wasn't a strong enough need to have the highest accuracy of master data.

You also need very good connectivity along the supply chain. And most of the time, there are still quite a few silos.

ANONYMOUS B

Got it.

VINCENT HABITZREUTHER

So this touches a bit on the obstacles of the supply chain. Nevertheless, the potential—especially for using AI, and it's called *decision intelligence*—in supply chain planning is where it can really make a difference.

Now, you have several vendors of software that are really supporting companies like mine and others to take steps in this direction. You can run maybe 10, 20 scenarios of supply chain planning operations at the same time and then choose the one that, you know, maybe focuses on the best and most efficient financial impact—so, the lowest costs—or focuses on serving all the customers, or most of the customers, and maybe financials come second if you are in a profitable business.

So it's really about how you run a company. It's always about different trade-offs between,

you know, serving your customers but also doing that in an efficient, cost-effective way. And this supply chain planning going into decision intelligence is what can really make the difference.

Of course, you can also use this to fine-tune your supply chain for sustainability. For example, if I have 200 orders in certain countries and we have this lead time to ship there, I might want to ship them by sea or by train, because that's the most sustainable way—instead of using a dedicated airplane. Which sometimes happens when you have to ship life-saving medicines, right?

You really need to plan your supply chain differently—consider the safety stocks you have, maybe ensure that in your manufacturing process you don't have downtimes, and that batch quality is always good. So it's really a different way of configuring the supply chain.

And what AI can do—if you have proper data, master data accuracy, and proper system integration—is help you orchestrate. Maybe the company is in a rough patch, then you optimize for finance. Maybe the company has an ambition to reduce CO2 impact, and then you optimize for sustainability.

And maybe you can even shift priorities each quarter—it depends on the products you sell, right? This is more possible in retail, for example. In highly regulated, long supply chains with slow manufacturing and quality control, you can't just change direction every other quarter. So it really depends on the industry.

And you have also ethical challenges. Oh yes—these are real. In a way, you have to keep the humans in the loop.

But, you know, my personal opinion—with the current geopolitical challenges—is that people and companies used to offshore supply chain manufacturing to reduce costs while still maintaining a certain degree of control.

Now, with globalization reversing, with added tariffs and all, it might be that some companies will move back into more so-called near-shoring. But then, they'll invest more in automation and in AI.

So it might be that eventually some countries will face higher unemployment. But this won't just be due to the implementation of AI. I think this will be mostly due to the geopolitical situation.

AI and robotics—for example, not having people on your manufacturing side or in your warehouse—robotics will actually be the bigger threat to low-educated, physical blue-collar workers.

ANONYMOUS B
Maybe a question to that. Many of the people I've interviewed now have said—they're all from Europe, right?—and everyone has kind of said, "Yeah, I think we have a problem, that we're falling behind. Especially in the EU, or especially in Germany, because we always regulate first and innovate second."

And when you look at the US, and also China, they innovate first and then regulate, kind of.

That’s the scheme. What do you think about that? Is that a problem we’re facing?

VINCENT HABITZREUTHER
Well, it is a problem. Because, you know, Europe relied a lot on globalization and did not prioritize having certain capabilities—like, for example, the semiconductor industry, right?

So first the US started thinking, “Hey, I want to have the capability to produce chips in my own country.” And then the EU came second, saying, “Hey, if something happens—like a war between Taiwan and China—we're all doomed.”

So then we started, I don't know, in the Netherlands and in Germany, building these capabilities.

Are we moving fast enough as the EU? Probably not. But I think after the World Economic Forum this year, and after seeing what it would mean to have a second Trump administration, it looks like Europe has awakened.

Now, the question is: will this awakening be sustained over time, and will the investments come?

But this is what I see—China, for example, is a very interesting market. It's a big market for any global company. But it might be that it’s no longer interesting to produce in China.

Maybe you want to have a fully automated factory, with robots, lots of AI and systems, and just a few people. And you might want to produce in Europe—especially when all this tariff war happens.

Yeah, I think it's a bit uncertain to know: is this just something temporary because Trump wants to make a statement? Or is this how the next four years—or more—will be?

I don’t think we lack innovation in Europe. We do innovate. But I think we are terrible at scaling. Because, you know, the European Union is not like the US.

Each country has its own language, its own laws. I think the European Union was too slow to really unify the market and offer good ideas a great platform to scale.

So I think a lot of good ideas from Europe end up being implemented first in the US—just because there, you do one website and you reach 300 million people.

In Europe, if you want to scale, you have to build 30 websites in 30 different languages, with I-don’t-know-how-many different versions of data privacy, tax authorities, and all that.

So I don’t think we innovate less, or that we regulate first. I think we just don’t offer a good platform for innovation to scale and become really strong.

ANONYMOUS B
When you say that about scaling up, maybe to the third point and with the best practices: What are you guys at Merck considering for successfully implementing AI—not just in

supply chain, especially there, but also in general?

VINCENT HABITZREUTHER
You know this saying, I mean, you can put lipstick on a pig, but it's still a pig.
Yeah. It's a pig. It's a pig. It's used quite often in a business context.

So it's the same with AI. I mean, as a technology and what you can do with it, it's great. But if your data and processes are rubbish, there is no holy grail to be found.

Now, there's a lot of money going into setting up AI departments, doing POCs. GenAI is a different story—and I'll talk about that—but really, when you think about scenario planning, machine learning, implementing robotics and all that, you need, at the same time, data governance, master data quality, easy integration between your application landscape.

And often, this is really legacy and old school, and very old systems are in the mix. That makes it all quite difficult.
Yeah, it's a tough thing.

But I would say, yes, you can show a POC and how great it is, but to scale that, you need to build the foundation.

So I would say, if you want to invest 5 million in AI, maybe spend 2 million on actually applying the technology, and 3 million on streamlining your processes—documenting them, having a data governance structure, and so on. Not just putting all 5 million into AI.

And I think the companies that really understand this will have a competitive advantage in the mid to long term compared to those who put all 5 million into AI.

That's interesting.

And generative AI, though, is different. Just as a side comment—because it's not really supply chain related—but in the world of marketing and sales, generative AI is really a game-changer.

Because there, it's about generating. It's not building on legacy, right? The way you can generate videos, copywriting materials, and so on.

So there, I can say, generative AI—and why I think it's also the hype around it—is because the value you get out of it is now, today.

With other types of AI , you need to have a very strong and robust foundation for it to truly work. You can make simulation models, but you know how it is: garbage in, garbage out.

You might get an output from your algorithm, but if you can't trust the data you put in, then you can't trust what comes out.

ANONYMOUS B
That's interesting. Everyone I've interviewed has said the same thing—that many people or many companies really struggle with their data, and they shouldn't even bother implementing any AI before they get on top of all of that.

VINCENT HABITZREUTHER
Well, you still have to do it—because it's a learning curve.

And if you add the challenges around it, it's also the skills of people in the organization. Because today, AI is in the hands of a few.

Think of a company like Merck—63,000 employees. How many of them use it in their daily jobs?

Of course, we have internally something like ChatGPT—a local version—it's called MyGPT. And you can chat; it's still generative AI.

But for the others, sometimes it's even a skill issue just to work with data—not even thinking about doing complex simulations in supply chain.

So, the skill aspect is also a challenge.

Now, going into smart manufacturing programs—because maybe this is something you also hear a lot in academia—it takes maybe 10, 15 years of talking about smart manufacturing until you actually start to feel the effects.

And we started this at Merck two, even three years ago. But it really takes time: to change the mindset, to prepare the company, to develop the first POCs.

Especially in a regulated environment like pharma, you can't just introduce a digital twin and a fully automated production line with IoT overnight. It's just not possible.

So, the change wave—it might take more than a decade. That's also a challenge.

Technology is there, but to make it work sustainably inside a company, it requires a systemic change—not just, you know, putting lipstick on a pig.

Yeah. Anything else you want to cover here?

So, digital twins—I think they are cool. But again, you need people who know how to work with them once they're created, and how to identify issues.

Predictive maintenance—the same. It's possible.

But cyber security threats are also a challenge when really going all-in, because once you automate and connect everything via the internet, cyber threats become an issue.

When it's an isolated system, it's safe.

Machine learning, RPA—this is more low-hanging fruit. Whenever possible, it gives you interim efficiency gains.

Generative AI can also help a lot—even in supply chain, for example.

It might be that a lot of regulations will change with countries and geopolitics being more

uncertain.

If I can help a company stay up to date with the latest regulations—and use websites where all these rules are published in every country—you can translate easily, create your own database, and then say, "Okay, what do I need to be aware of if I want to ship to Indonesia?"

Then you can see what the latest import regulations are—especially if it's risky materials, not just pens and pencils.

That's a great use case.

Also, in generating quality reports or documentation—things that would otherwise take a lot of time—that's where it can help.

Anything else you want me to go deeper into?

ANONYMOUS B
I think that does the job. That's all right.

I kind of have to stick a bit with the questions. Otherwise it'll be taken out of context with the other results I've got from the other interviews.

But it's very, very good. And, um, yeah—when I call you guys "experts" in my thesis, I think it's probably worth calling you that.

VINCENT HABITZREUTHER
What are the others kind of saying? Are they on a similar line, or is there something really different from what I shared?

ANONYMOUS B
It depends. Some of them are maybe in a different context—how they work and what they do.

Some of them—like, I interviewed someone from Medtronic.

VINCENT HABITZREUTHER
Yeah, yeah.

ANONYMOUS B
That guy's no longer at Medtronic—it's been three or four years—but he still has the insights, and now he's an independent consultant.

And what they do now is a bit different from what was possible three or four years ago.

But all of them, as you said, are kind of saying the same thing: it's sink or swim.

He was the global head of the whole supply chain, and he said he created an entirely new team from the ground up—just to get on top of all the data and insights.

He said, "Analytics."

Because, as he put it, “We don’t need a pig with lipstick. We want a nice animal.”

9.5.8

Interview H

VINCENT HABITZREUTHER
So, right, here are the questions. First of all—oh, one more thing, maybe important to ask beforehand: do you want me to list you anonymously, or would you prefer to be mentioned by name? Some interviewees preferred anonymity, others wanted to be named—that varied.

Andreas Pfau
That’s relatively irrelevant to me. The thing is, as I already mentioned to you, there weren’t many people involved directly in SCM itself. So, if it helps you and you don’t have enough other names, feel free to include me. But I wouldn’t consider myself a top reference on the supply chain topic.

No, I know that. I’m not a CPO or anything like that right now, where you’d say, “Ah, cool, I interviewed him.” You can decide that. I’m fine with it if you want to include me, just to show who you spoke to. Of course, if later someone asks you more questions about the interview or who you asked—yeah, then it’s okay.

VINCENT HABITZREUTHER
Okay, all right, got it. Cool—let’s start right away with the first question. Could you maybe give me an overview of your professional career so far, especially in terms of your experience with AI?

Andreas Pfau
In supply chains, yes. I’ll just cover 1.1 and 1.2 together, also with the corporate courses we’re active in—so, yes.

I’m Andreas, 43 years old, and after the usual school path, I studied computer science at Kaiserslautern, focusing on classical computer science with a bit of business informatics at the time. My thesis was done in collaboration with the DFKI, the German Research Center for AI in Kaiserslautern. The topic was knowledge management for the personal workplace—so how you can better manage your own files and information.

After that, I started working in consulting—initially at BearingPoint for four years as a consultant in the areas of data warehousing and business intelligence, mostly in finance but also a lot in insurance. Then I moved to a smaller consulting company called Opens Consulting, where I started taking on project management responsibilities in addition to data warehouse and BI topics. I also handled team leadership tasks there.

Eight years ago, I joined Bilfinger. I first took over IT-PMU, then later the CAO Office. I then assumed responsibility for the PMU of a harmonization project, which was a SAP rollout project. Over time, I took over the CAO Office area and the program management for the PSH project—because there were always multiple rollout projects running in parallel.

After the agile transformation, I also led the Tribe Business Solutions. I was involved in five projects in total. For the past five years, I've been the CISO at Bilfinger—so I'm responsible for cybersecurity.

Currently, I work in the industrial services sector, where I serve as CIO and CDO—Chief Information and Digital Officer—for a company with 30,000 employees.

I've gained a fair amount of experience with AI in the supply chain, and of course quite a bit with AI in general, since we're heavily involved in IT and digitalization. We also test current solutions in collaboration with Corporate Procurement.

My personal experience in the supply chain field is not as deep—I haven't worked directly in SCM in that form.

VINCENT HABITZREUTHER
Cool. Then to the first content-related question: What significant obstacles do you see in implementing AI in supply chains?

This can also be more generally in business—especially from the perspective of the various stakeholders involved. Maybe as background info: most of the people I've spoken to so far, including those involved in supply chain management, have mentioned data and insights—analytics—as the key issues. What's your take on that?

ANONYMOUS B
Yes, that's exactly what I would have said spontaneously.

I mean, the main challenge you always face when implementing AI is of course the question: on what data basis is the AI trained? For which use cases? And what kind of information can and should it process accordingly?

From a stakeholder perspective, it becomes interesting when I'm involved in monitoring or using supply chains. If I need to look into the AI, I have to obtain data from companies and organizations that are not my own.

This means I'm confronted with the issue of secure data exchange. On the one hand, I have to collect information from suppliers, and on the other, that information must also be securely stored—from the suppliers' point of view.

It's the same issue you always have in supply chain monitoring. If you compare it to cybersecurity, it's quite similar. We try to create security by asking lots of questions.

Many of those questions are confidential. So, in the end, you turn to certificates and third-party, independent auditors and ask: who can verify this?

So yes, the obstacles are definitely data availability and data security—both from the perspective of those who want to use the data and from those who have to provide it.

VINCENT HABITZREUTHER
Do you see another key point here?

Some people have also said that companies simply aren't ready—that they don't even have their data management in place yet, that it still has to be built.

I spoke with someone from Medtronic—he used to be the Global Supply Chain Manager—and he said many companies don't understand their data at all. That doesn't necessarily mean they can't manage it, but they simply don't *have* the data yet. And so, of course, they can't manage what isn't there.

Andreas Pfau
Yes, exactly.

If you go one step deeper: we just said you need to ensure data and data security. The next step is of course: does that data even exist? Can companies even provide it?

So the real question becomes: with what information can you even engage in such an exchange?

And what would secure platforms for this look like?

Yes, there is something like an escrow service—like in software development, where a service provider develops a product and the necessary code is stored with an independent third party, so both sides can access it if needed, and it stays independent of the business success of either party.

Something similar would need to be established here. But we're still far away from that.

I see it the same way. Everyone is collecting their own information and just trying to somehow make use of it.

Yes, I can definitely confirm that.

VINCENT HABITZREUTHER
There is no holistic solution. Okay, then maybe on to the next point:
How can AI contribute to promoting sustainability—which is also a major topic for us at Bilfinger—and to optimizing global or international trade?

Andreas Pfau
That is naturally a very broad field.

From the perspective of Bilfinger, promoting sustainability always goes hand in hand with efficiency. So wherever we act more efficiently, develop businesses more effectively, use less energy, and produce less waste—things become more sustainable.

Sustainability, in this case, can also be understood in the sense of long-term viability: conducting business that is secured in advance for the long run—building partnerships that last.

The optimization of international trade is, I believe, an even broader field.

But optimization is, of course, always enabled by necessity—because an AI can analyze and

optimize a significantly broader data base than a human can.

Whether it's about flows of goods, supply and demand dynamics, or even the products I need to buy—AI can help.

Sometimes I'm unsure whether I've received the best quality or overall the best product for the price.

That's where AI comes in—for example, in the software supplier sector. There are already several AI-based startups and companies that allow you to assess: Where can I buy which functionality in which product?

That alone can already optimize a lot.

VINCENT HABITZREUTHER
Yes, cool.
Let's move to question 2.3: What regulatory or possibly ethical challenges are there in the integration of AI—especially relevant in supply chains?

Many have mentioned the EU AI Act.

Andreas Pfau
Yes, well, that would be the obvious one now.

I mean, the EU AI Act plays a role here. Supply chains, due diligence, protection laws—these are, of course, part of the discussion.

If we leave regulation aside for a moment: ethical challenges are always present when we ask to what extent something like a market overview—generated by AI—creates unfair preference.

For example, suppliers who provide more data might automatically perform better or get better treatment, while others—who may be more reserved—could be disadvantaged.

So the question becomes: up to what point, up to how much data should I be expected to provide to an AI to benefit from it?

Yes, regulatory challenges are definitely present in situations where one needs to ensure proper security, compliance, and so on.

Ethically, I'd say a practical example would be:

Let's say I want to ensure that there is no child labor in the supply chain.

There are now certificates where someone simply confirms: "We do not engage in child labor."

But what would be an ethical challenge?

Well, I could also say: "Give me all your employee data, including their dates of birth, and I'll

check for myself whether any children are employed."

That would clearly be an ethical problem—because these are data that you should never have to share, and in most cases, are not even allowed to.

VINCENT HABITZREUTHER
Yes. Do you also feel that it has an influence that Bilfinger is a European company—and that it therefore can't just follow along with innovation as freely as companies in the U.S., for example?
Because over there it's innovation first, then regulation—while here, it's regulation first, then innovation?

Andreas Pfau
Yes, so if you bring it to that level now, then yes. I would even want to include the Asian countries in the comparison because I definitely see that in the U.S. we follow an "innovation first, regulation later" approach—but also with a very paranoid stance when it comes to data.

It only seems "better" because the large hyperscalers are all based in the U.S.

But if you want to talk about avoiding ethical challenges, take a look at the current people-scoring models in China. There you can see what can be achieved without ethical boundaries—also in relation to supply chains.

So, when thinking about an extended supply chain—if your social score drops below a certain threshold, which can be determined solely by how many times you've run a red light—you may suddenly not be able to get a loan.

Yes, that's an ethical issue. You have to look at this on a global scale—what would technically be possible, and what, for instance, even an American company would never do. That has to be said clearly.

VINCENT HABITZREUTHER
Okay, interesting. Then let's move on to the third cluster of questions.

This one leans more toward the consulting angle, but it might also be interesting to hear your view:
What best practices should be considered—or do you consider promising—for successfully and effectively integrating AI?

Andreas Pfau
So, the classic consultant would of course say: Find a good use case. Find a data-rich interface where you get a lot of information, so you can build a meaningful integration around it.

For example, in bidding processes or similar settings, you naturally receive a lot of company-related data. From there, you could provide a lot of material to a large language model.

Or, if you're considering agent-based approaches, it's often about process-oriented analysis: identifying positions in a process—or in a supply chain process—where you know there's a

high workload, lots of manual steps, or a high degree of media disruption.

Whether there are actual “best practices” already? I’m not sure. I think a lot of information appears to be available today in these areas that we may not yet be fully utilizing.

Also, in relation to successfully published information online.

And as I said before: promising success always comes from starting small and thinking big. Don’t aim for the giant leap from the beginning. Take small steps to approach the bigger picture gradually.

VINCENT HABITZREUTHER
Understood. Maybe directly following up on that—the next question:

How do you think AI will change the competitive landscape in supply chains—but also, more broadly, in business and international trade?

Andreas Pfau
This is a question you could almost answer philosophically.

If you imagine that you have access to an adequate and comprehensive data foundation for all offerings, then you no longer need to conduct your own sourcing. The AI can do that for you.

That means, what you need in order to provide your own services and products becomes part of an automated request process—where an AI with an agent-based solution will deliver exactly what’s needed.

So, how will it change things?

What we’ve known as “traditional trade,” in my view, will increasingly require transparency. And as a result, human involvement in these dependencies will become less and less necessary.

There will still always be dependencies in areas where things aren’t standardized. But in the classic scenario—“I need parts, I need materials with specific characteristics and certificates”—AI and agent-based AI will, in my view, fundamentally revolutionize that space.

Because in the end, I’m simply saying: I need X sheets of steel, with Y quality, and Z specifications—for my car.

Now show me the best price from the supplier that meets those criteria.

So it becomes highly automated. But that also poses a challenge.

It will make international trade much more transparent—regardless of tariffs.

An AI can already calculate such developments and find the optimal point for you.

From the supplier’s point of view, that’s going to be very difficult.

Because what used to be built around strong customer or supplier relationships may take a backseat in such moments.

VINCENT HABITZREUTHER
Yes, no, I think so too.

Andreas Pfau
And that would also be the question—what comes after in terms of new AI technologies.

From my point of view, the next stage of development that's still missing in the examples we've discussed is *agentic AI*.

What we're currently seeing is that we're generating understanding through Generative AI, through Large Language Models, through Deep Learning.

But with agentic AI, it's about decision-making—especially from within uncertain contexts.

If the situation were safe and deterministic, you could simply use a robot or RPA: input parameters 1 to 8, and if X occurs, then do Y. That's sourcing via RPA—you don't need to think much.

But agentic AI is essentially about mimicking a decision-making process based on uncertain data—with a certain probability of choosing the right option.

The challenge here is also: I saw this recently at a conference—you need a leadership framework for such agentic AI solutions.

And then the question becomes: is the agent, who can fully consolidate, integrate, and consider *all* SOPs, policies, and laws at the time of decision-making, actually a better decision-maker than a human employee who may have five years of experience, who makes good decisions, yes—but who certainly hasn't reviewed every law, policy, and SOP at that moment?

Whether the agent's decision is better—just because the human doesn't recheck all those documents—is up for debate. But the newer AI technology is definitely query-based.

Request-driven. You say: "I need something that can do this and that," and it then makes a decision based on that.

Today's version would be:
"I'm looking for a supplier who can deliver 10 tons of steel to me at price X."

Tomorrow it will be:
"Find me 10 tons of steel at the best global market price—you have the following budget, and I need it by the day after tomorrow."

And then the agent starts acting—it makes the procurement decision, the supply chain decision—end to end.

VINCENT HABITZREUTHER

Do you already have—or know of—any kind of use case or example where you'd say Bilfinger might already be using AI? Have you heard anything about that?

Andreas Pfau
Yes, we do have some use cases where we're already applying it.

For example, we're using Ask.io—it's a procurement AI solution where you can already initiate requests like that.

We've also tested a startup called *Knouing*—spelled K-N-O-U-I-N-G, sort of derived from "knowing."

It's essentially exactly what I just described from an inquiry perspective:

"I need a piece of software that can perform the following functions—
Which supplier can deliver it?"

Maybe even coupled with our own products—
Which of our own products could already fulfill this purpose, and I just don't know it yet?

These are AI solutions we're actively using—also for market research and similar tasks.

VINCENT HABITZREUTHER
Okay, cool. That was all the questions—that's everything.