

Facing the Labor Shortage in Supply Chains: What AI Solutions for Businesses?

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Abstract

Talent recruitment and labor shortages are a major challenge in Switzerland. However, the emergence of new technologies based on artificial intelligence (AI) has the potential to revolutionize the labor market.

This white paper presents the potential impact of AI on labor shortages, particularly in supply chain professions. It combines quantitative and qualitative methods to provide concrete recommendations to Swiss companies for the optimal integration of AI in supply chain professions.

Introduction

Global supply chains (SC) are under unprecedented pressure. An ageing workforce, successive economic crises, deteriorating employment conditions, the COVID-19 pandemic and the Russian-Ukrainian war have converged to create acute skills shortages across multiple sectors (Belhadi et al., 2021; Brunello & Wruuck, 2019; Ivanov & Dolgui, 2022; van Hoek, 2020). These shortages span both core operational roles, such as harvesting, retail and basic construction and high-skill domains like ICT, finance and managerial roles, severely undermining the resilience and performance of supply networks worldwide. Among the impacted fields, supply chain management (SCM) has experienced persistent recruitment difficulties, with both low- and high-skilled roles affected (Belhadi et al., 2021; van Hoek, 2020).

In the fourth quarter of 2024, employment in Switzerland grew moderately by 0.9% compared to the previous year (swissinfo.ch, 2025). However, despite a decrease in the number of job vacancies, difficulties in recruiting qualified personnel remain significant. According to Economiesuisse, the country will face a shortage of approximately 460,000 full-time employees over the next ten years (Economiesuisse, 2024). Critical roles such as planners, inventory managers and logistics coordinators remain persistently hard to fill, driving up costs, threatening service levels, and ultimately weakening the global competitiveness of Swiss industry (Jaberg, 2022; Minter, 2021; Nagurney, 2021). The severity of these shortages is also reflected in international risk assessments. The Allianz Risk Barometer 2025 identifies talent and labor shortages as the fourth most significant business risk worldwide (Allianz Commercial, 2025), while the World Economic Forum's Global Risks Report 2025 ranks it among the top global risks for the decade ahead (World Economic Forum, 2025).

To address this multifaceted challenge, organizations have implemented a range of short- and long-term strategies, from financial incentives and diversification of recruitment profiles to vocational training and apprenticeship programs (Adekunle & Jha, 2024; Kömüves et al., 2024; Nagurney, 2022). Increasingly, digital transformation and the deployment of artificial intelligence (AI) technologies are being considered as key enablers of resilience and productivity within SCM functions. A growing body of scientific literature highlights how AI can alleviate labor shortages while improving operational efficiency. In particular, AI enables task automation, better resource allocation, and real-time process optimization in domains such as logistics, warehousing, inventory management, and demand forecasting (Bhattacharjee et al., 2021; Bogue, 2024; Dawson et al., 2020). In construction and manufacturing, robots and 3D printing systems support the execution of routine or physically demanding tasks, thereby reducing dependency on manual labor (Ceric & Ivic, 2020; Gupta et al., 2023). In agriculture, AI is used to improve crop yield prediction and reduce food waste (Bogue, 2024).

AI-driven systems, especially those using machine learning (ML) and deep learning (DL), are increasingly employed across key SCM processes. These technologies enhance predictive capabilities in areas such as demand forecasting, risk management, supplier selection, and quality assurance (Mediavilla et al., 2022; Toorajipour et al., 2021). By integrating contextual variables such as weather or events, these tools enable improved planning and responsiveness (Younis et al., 2022). Moreover, AI can support human resources decisions through labor market trend analysis, workforce planning, and customized training (Adekunle & Jha, 2024; Dawson et al., 2020).

Nevertheless, the integration of AI into SCM is not without challenges. Existing studies point to barriers such as the lack of practical applications, insufficient employee skills, ethical and legal concerns (Hangl et al., 2022; Hosseinnia Shavaki & Ebrahimi Ghahnavieh, 2023). Furthermore, the transition to AI-

enhanced systems requires significant investments in staff training and digital infrastructure (Heeres et al., 2023). The challenges of implementing and adopting AI are compounded by the need for collaboration across multiple firms and the requirement to share information and data throughout the SC (Shrivastav, 2021).

AI is increasingly recognized as a strategic lever to address labor shortages in SCM by enabling automation, upskilling, and human–machine collaboration (Bhattacharjee et al., 2021; Frederico, 2023). Applications can be structured by task type (administrative, analytical, physical), expected impact (automation, augmentation, assistance), and maturity. Traditional decision-support approaches—fuzzy logic, expert systems, heuristics/metaheuristics, and simulation—are well established in planning, scheduling, facility location, and supplier selection (K Kar et al., 2019; Pournader et al., 2021; Toorajipour et al., 2021). By contrast, ML/DL, CV, and NLP are expanding rapidly but remain unevenly deployed due to data and integration challenges (Pournader et al., 2021; Younis et al., 2022).

For administrative tasks, NLP and OCR streamline procurement, compliance, and customer service through automation and assistance (Pournader et al., 2021; Toorajipour et al., 2021). Analytical tasks increasingly rely on ML/DL for forecasting, inventory and risk management, with reinforcement learning and BDA enhancing disruption detection and visibility (Mediavilla et al., 2022; Shavaki et al., 2023; Shen et al., 2024; Dash et al., 2019; Zamani et al., 2023; Hu et al., 2023; Younis et al., 2022). Physical tasks benefit from robotics, cobots, predictive maintenance, and CV in quality control and reverse logistics (Dash et al., 2019; Kelly, 2024; Shen et al., 2024; Li, 2024; Bhattacharya et al., 2024).

Mature techniques (fuzzy logic, expert systems, simulation, metaheuristics) remain deeply embedded in ERP, WMS, and TMS (Pournader et al., 2021; Toorajipour et al., 2021). Accelerating solutions include ML/DL for forecasting, inventory optimization, and quality control (Hosseinnia Shavaki & Ebrahimi Ghahnavieh, 2023; K Kar et al., 2019; Mediavilla et al., 2022). Emerging approaches—conversational NLP, automated multi-tier mapping, advanced CV—remain constrained by data availability (Bhattacharya et al., 2024; Pournader et al., 2021; Zamani et al., 2023).

Adoption barriers persist, notably data silos, limited traceability, shortages of combined technical and domain expertise, explainability concerns, and legacy integration (Pournader et al., 2021; Younis et al., 2022). Overcoming these requires robust data governance, advanced architectures, mature MLOps, and alignment with business KPIs (Pournader et al., 2021; Zamani et al., 2023). Accordingly, priority areas include automating administrative routines (NLP, RPA), augmenting analytical tasks (ML/DL, BDA), and progressively automating physical operations (robotics, CV, predictive maintenance). The convergence of AI, BDA, and automation thus emerges as the most resilient pathway to mitigate labor shortages while reinforcing SCM performance and resilience (Pournader et al., 2021; Zamani et al., 2023; Zhang, 2025).

This white paper aims to explore how AI technologies can serve as strategic levers to mitigate labor shortages in SC professions. Based on a comprehensive review of current research and empirical insights from Swiss companies, it offers operational recommendations for businesses seeking to adopt AI technologies and solutions that are aligned with their human capital and organizational needs. By bridging empirical fieldwork and cutting-edge research, this guide aims to support businesses in navigating workforce scarcity, unlocking AI's potential, and building technologically advanced, people-centered SCs.

Methodology

The present project is of an interdisciplinary nature, bringing together researchers in the fields of data engineering and SCM. It employs mixed methods with data gathered through literature review, online survey and semi-structured interviews (Johnson et al., 2007).

It is structured around three phases:

1) Field data collection. From January to March 2025, an online questionnaire was conducted to assess the extent and characteristics of the labor shortage, as well as the current and potential use of AI-based solutions. The questionnaire received 103 responses. Following the data collection, responses were cleaned and recoded to ensure accuracy and comparability. Statistical analyses were performed in SPSS (Statistical Package for the Social Sciences) to examine relationships among variables. To complement the quantitative results, semi-structured interviews were carried out with professionals from the SC field. A total of 10 organizations were represented in the interviews, covering a broad range of industries:

- Retail and wholesale
- Consulting and engineering
- Manufacturing and industry
- Construction materials
- Standards and governance

The interviewees held various functions such as SC manager, project manager, head of procurement, and SC director. Their professional backgrounds are diverse, ranging from IT and logistics to engineering and academic teaching. The company's and interviewees description can be found in Appendix I. This diversity ensures a comprehensive view of SC practices in Switzerland. To preserve confidentiality, the information presented in this white paper is anonymized when necessary. However, the sectoral and functional diversity of the participants contributes to the robustness of the findings.

Each interview lasted about one hour and followed a structured guide covering five topics:

- Assessment of the labor shortage in the respondent's sector.
- Perceived causes of the shortage (structural, cyclical, institutional).
- Most affected roles, profiles, and skills.
- Implemented measures to address the shortage.
- Current or expected impact of AI, whether mitigating the shortage, reshaping roles, or potentially worsening some effects.

Interview transcripts were analyzed using thematic analysis (Braun & Clarke, 2006), with systematic coding to identify categories, recurring patterns, and significant variations in viewpoints.

2) AI solution mapping. This phase aimed to identify the types of AI solutions best suited to mitigating the effects of the labor shortage on the professions identified. A literature review of existing AI applications in the SC supported this mapping. The proposed taxonomy is based on:

- The family job and related tasks involved in each profession.
- The expected impact of AI.

The list of supply chain professions was first harmonized by merging two independent occupational taxonomies and consolidating overlapping or near-synonymous titles into unified roles (Pournader et al., 2021). A structured literature review covering the period 2010 to 2025 was then conducted in English across multiple academic databases and search engines. For each consolidated role, targeted queries combined the profession with supply chain terminology and AI approaches. The records were screened by reviewing titles and abstracts, followed by a selective reading of the full text to assess relevance. Only contributions directly related to SCM such as academic articles, conference papers and other scholarly studies were retained (Toorajipour et al., 2021). From each source, we extracted the problem context, task category, expected impact, data and integration requirements and reported outcomes, and organized this information according to the analytical framework described above (Mediavilla et al., 2022; Toorajipour et al., 2021).

The consolidated findings were then assembled into a multi-page document from which a summary table was derived to present the correspondences between professions in SC and AI tools (see Appendix II).

- 3) **Recommendations and operational guide.** The final phase consolidates the results into a practical and illustrated guide, aimed at helping companies identify the appropriate AI solutions for the professions they find difficult to fill.

Results

Respondent profile

The online questionnaire gathered 103 responses. The respondents were primarily based in the French-speaking part of Switzerland due to the territorial anchorage of the project team (Figure 1).

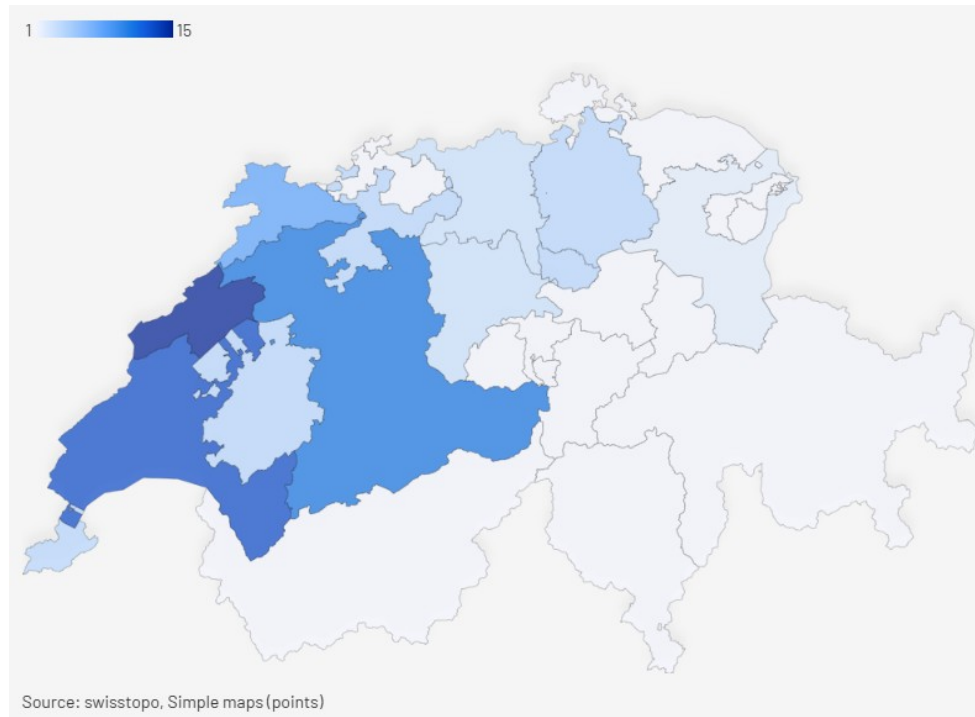


Figure 1. Location of respondent companies (personal elaboration based on the results of the questionnaire)

Most respondents (62%) are between 30 and 49 years old, and 65% hold a bachelor's or master's degree. Most occupy roles such as logistics manager, SC manager, SC director, procurement specialist, or project manager within logistics or SC functions. These professionals are relatively new to their positions as 43.4% have held their current roles for one to three years. The sample is composed of 80 men and 23 women.

The most represented sectors are manufacturing (mainly within the watchmaking and food industry), followed by trade, medical industry, transport and warehousing, reflecting the diversity of fields involved in SC professions (Figure 1).

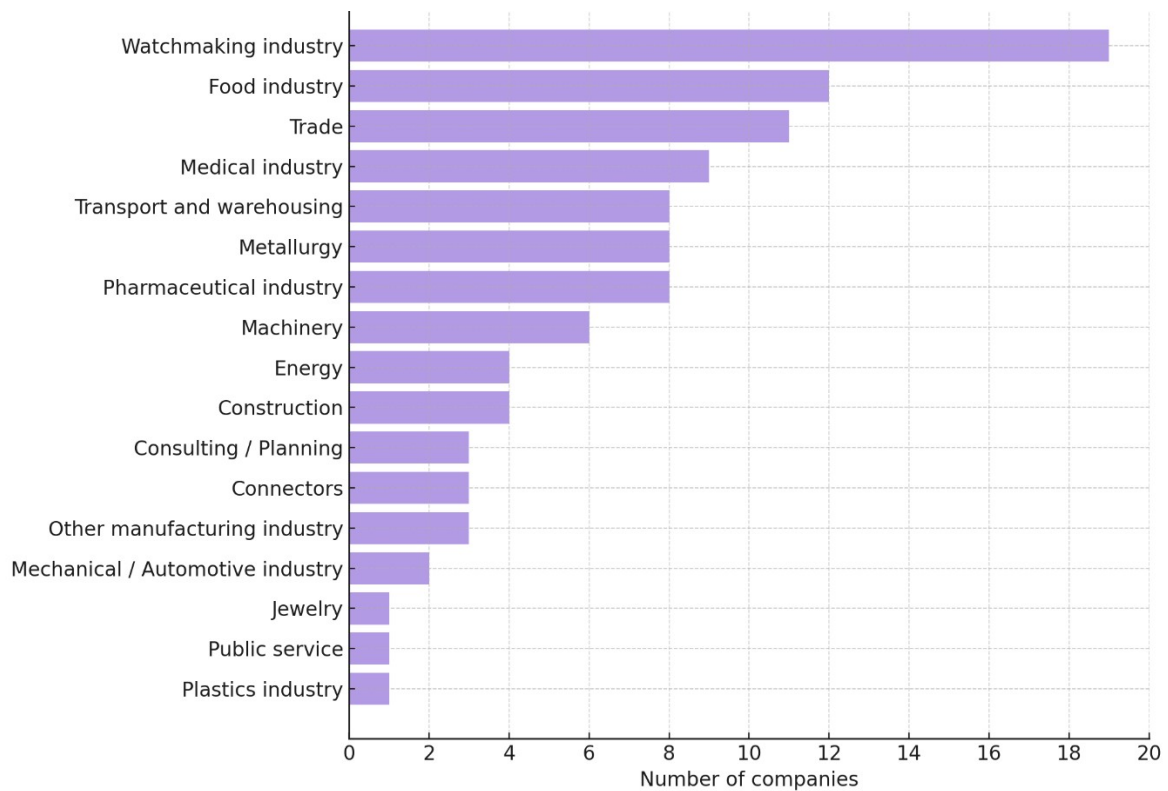


Figure 2. Distribution of companies by industry sector (personal elaboration based on the results of the questionnaire)

Our sample is mainly made up of big companies, with about 41% with more than 1000 employees (Figure 2). The data show that most companies have relatively large SC departments (including inbound, outbound, and intralogistics, as well as procurement). One-third of the firms surveyed employ between 20 and 49 people in their SC function (33%), while 28.2% report having more than 50 employees. Mid-sized departments are also common, with 16.5% employing 10 to 19 people and 15.5% employing 5 to 9. Smaller structures are rare: only 3.9% have 3 to 4 employees, 1.9% have 1 to 2, and just 1% report having no dedicated SC staff at all.

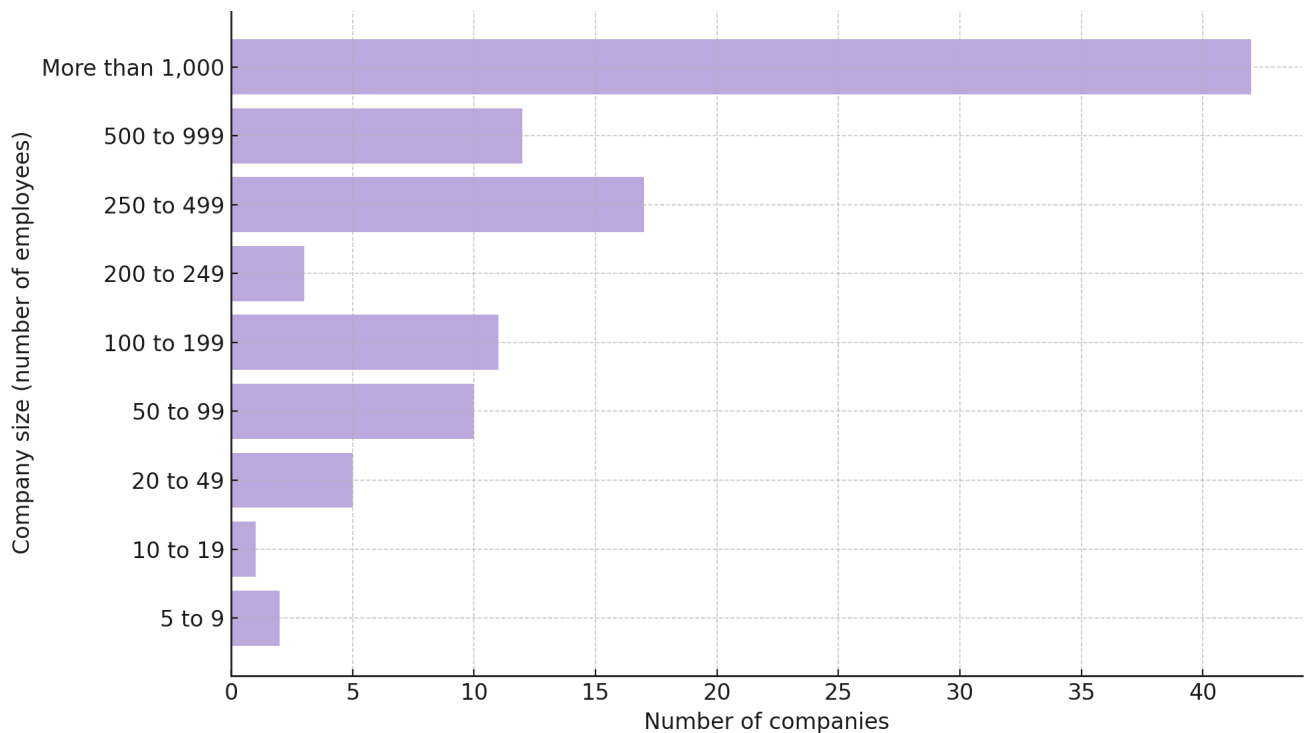


Figure 3. Distribution of companies' size (personal elaboration based on the results of the questionnaire)

Labor shortage

The data confirms a persistent crisis in SC talent acquisition. More than two-thirds of respondents (70%) reported experiencing a moderate to very high level of difficulty in recruiting qualified personnel (levels 3 to 5 on a scale from 1 to 5), highlighting the scale of the phenomenon. Conversely, only 19.5% indicated little or no recruitment difficulty, while 10.7% stated that they did not know. This assertion is corroborated by semi-structured interviews, which provide additional insights into the subject matter. Most of the interviewees attested to a shift in the intensity of the shortage since the onset of the pandemic, with global SC operating under persistent pressure. "Covid has highlighted the importance of supply chain professions." It is further noted that changes in the behavior of employees are emphasized. "Since COVID [...] people have changed their behavior [...] even people looking for work are not accepting the jobs they would have accepted before." In recent years, candidates have become more demanding in terms of comfort, work-life balance, and working conditions, which has exacerbated the shortage. One of the respondents noted that: "It's not a question of finding workers, but rather the quality of the candidates." Another noted a shift in the "balance of power" in recent years, with qualified young candidates having higher expectations (requests for part-time work, remote work, higher salaries):

I feel that the balance of power has shifted somewhat. When I started my career, [...] the company came first. It was up to us to adapt, and so on. Now, I feel that young people have much higher expectations and demands.

These results confirm that labor market tensions in SC-related professions are widespread, although perceived with varying intensity. Indeed, about half of the respondents mentioned that it takes less than six months to fill a position in the company once it has been advertised, when 36% said it takes between six months to one year.

The roles for which companies have the most difficulty recruiting qualified personnel are mainly "Planning" (demand or supply planning), followed by "Procurement", "Logistics/Warehouse" and "Transport." Employment related to Analytics/IT/Data ranks fifth. While semi-structured interviews corroborate the difficulty of finding suitably qualified individuals in planning and purchasing, they also highlight the challenge of finding individuals who are versatile: "[...] for small company [...], in fact, it's very difficult to find people who are capable of managing all these areas at the same time."

Regarding the competencies, the most sought-after skills are primarily technical (planning, information systems, procurement management), followed by social, language, and digital skills (Figure 4). For one respondent to semi-structured interviews, the most significant challenge is linguistic aptitude. The company is currently seeking to recruit individuals with specialized profiles who are proficient in French, English and German, a task which is rather challenging.

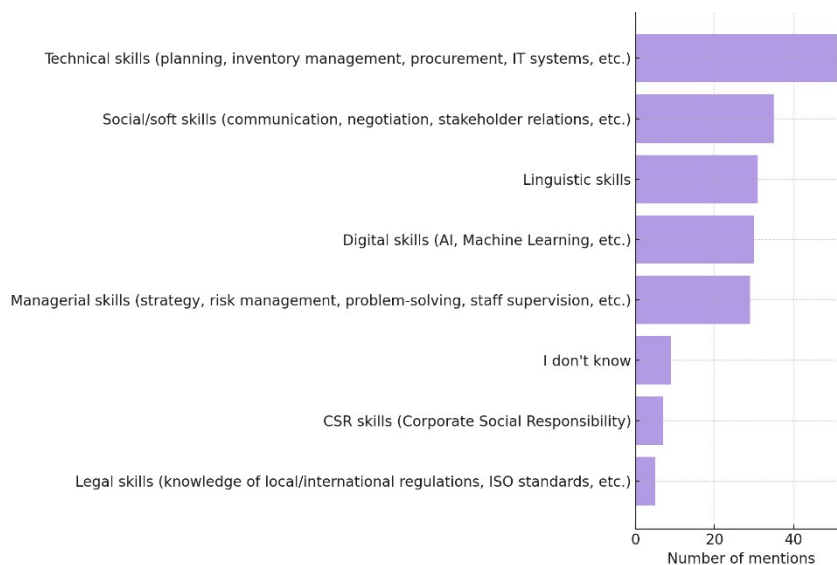


Figure 4. Skills difficult for companies to find (personal elaboration based on the results of the questionnaire)

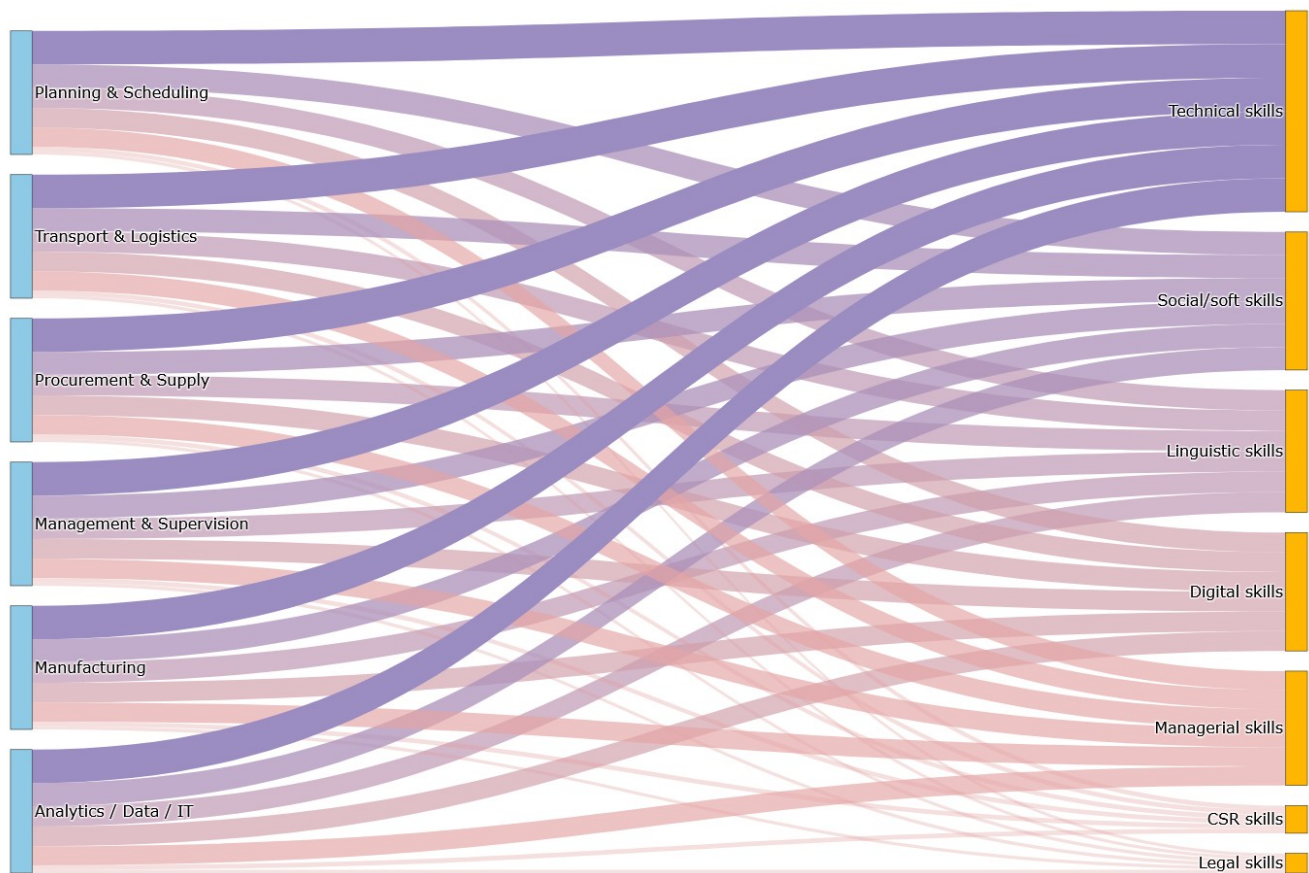


Figure 5. Sankey diagram illustrating the relationship between labor shortages by activity domain and by skill set

Skills shortages are widespread and affect all domains. They are most pronounced in planning and scheduling, while transport and logistics as well as procurement and supply remain under marked pressure. Supervision, production, and IT/analytics are less exposed but still non-negligible. On the competency side, technical skills lead, with social, linguistic, digital, and managerial needs of comparable magnitude, whereas legal and ESG/sustainability capabilities are smaller yet clearly present (Figure 5).

Causes of labor-shortage

For respondents, the primary causes of the current labor shortage in SC professions are a mismatch between the skills available on the market and those required (Figure 6). The SC is seen as a multidisciplinary field requiring both solid process knowledge and strong interpersonal and communication skills. Managers are often tasked with announcing production issues or delays, a responsibility that demands clarity and tact in communication.

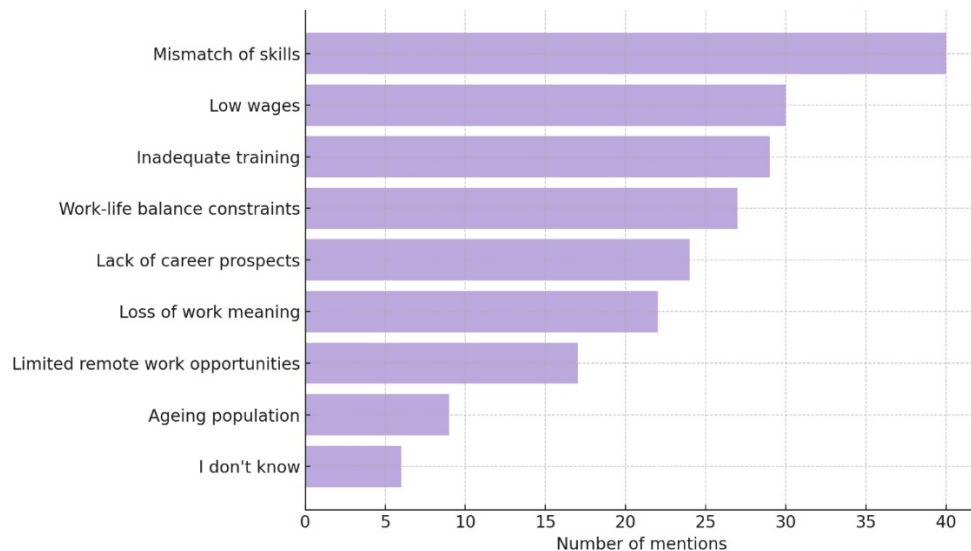


Figure 6. Causes of skilled labor shortage (personal elaboration based on the results of the questionnaire)

Recruitment challenges are particularly acute in planning roles, which are rarely the result of targeted initial training; professionals often enter the field by coincidence rather than through a dedicated educational pathway. Expertise in customs regulations, currently in high demand for both imports and exports, is also scarce. Respondents emphasize the difficulty of finding candidates who are already trained, qualified, and immediately available on the job market. Low wages also constitute an obstacle. As one interviewee notes: "Young graduates [...] are asking for salaries that we cannot meet. [...] Today, the first issue is salary expectations. [...]."

Other challenges stem from the breadth of responsibilities in certain roles: "The range of responsibilities is quite broad [...], sometimes we had one person who was responsible for one of the four areas, but not all of them." An interviewee also mentioned the lack of profiles combining technical and interpersonal skills, particularly for roles in customer relations. According to the interviewee, this is due to the virtual absence of specialized training in the SC domain.

In warehousing and logistics, one respondent also highlights the erosion of skills linked to retirements:

People [...] who retire also leave with a certain amount of knowledge and skills, and as the famous baby boomer generation increasingly retires, there are fewer and fewer people coming up behind them [...] and they leave with a wealth of knowledge, practices, and little tricks, and one typical problem is maintaining the quality of service and work provided by employees.

Finally, while some required skills exist on the market, they may be geographically distant: "The skills sought are available on the market, but it is necessary to look quite far afield (cross-border workers), and there is no possibility of filling the positions internally."

The role of the SC is somewhat "invisible" and consequently underestimated, resulting in a lack of appeal for those professions. One cited a generational factor: younger generations want their work to be visible and valued: "Now there is a generation that wants to be in the spotlight; they don't want to be the people behind the product." Long working days can discourage some people from pursuing these careers. The global nature of the SC can necessitate work in different time zones. Therefore, there is a

need for HR initiatives: for example, "we have introduced a policy of replacing phones every two years to attract the younger generation."

Some respondents mentioned that there is a need for training. "The key factor is [...] training that leads to this activity, and possibly promoting the profession of planner, which is perhaps not sufficiently done among young people who are in training or leaving compulsory education." People are not attracted to this type of profession anymore because it is not very appealing and is too repetitive, therefore there is potential for automation, for example by replacing it with a robot. There is a change in mentality: "People changing careers more easily if they are dissatisfied with conditions ("job hopping"). In supply chain field where the work is often physical, mentally tiring, and involves long hours. This can push people to change directions."

Today, candidates demand good working conditions, work-life balance, and comfort, for example "candidates who withdraw because there is no parking space." One also points out the lack of attractiveness of the SC, as it is a field in which new problems must constantly be solved:

Supply Chain as such does not have a good image. [...] It's a daily hassle. You see, you order something from any website, you receive half of it, not everything is there. That's real life in the world we live in when it comes to the transportation of goods and flows coordination.

One respondent emphasized this lack of attractiveness and the flight of more qualified profiles to other fields:

There is a brain drain of the most qualified profiles to other sectors. In the past, the supply chain was a field that received a high volume of applications [...] we often call on recruitment agencies because the market is complicated in this field today. We don't get as many applications as we used to; it's a profession that attracts less interest than before. And then I also see in education that we have a lot of students who don't stay in the profession after their training. [...], we have a profession that has a bad reputation in French-speaking Switzerland. We still have this image of the storekeeper, even though the profession has changed significantly. On top of that, the salaries are not particularly attractive. [...] We end up with pizza delivery drivers, with that type of profile. Very few people with a CFC (certificate of professional competence) apply.

Labor-shortage consequences

The most frequently mentioned consequences are work overload, project postponement, a loss of capacity to innovate, and a decline in competitiveness. A negligible number of respondents cited the loss of customers or market share and investments postponement (5.3%) (Figure 7).

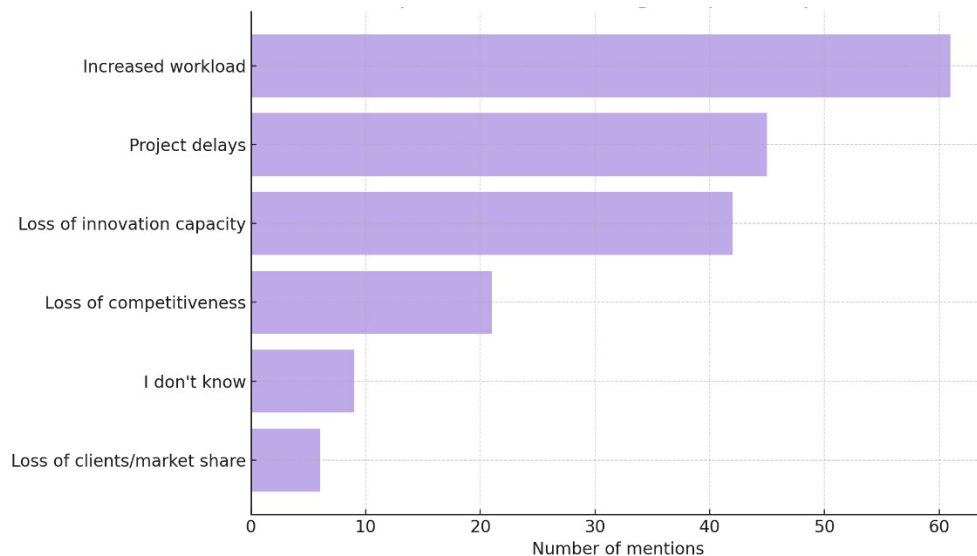


Figure 7. Consequences of skilled labor shortage (personal elaboration based on the results of the questionnaire)

This is also confirmed by the semi-structured interviews, in which nine out of ten respondents primarily mentioned work overload:

"Today, even when I have someone who is absent or sick, in any sector, I feel it. [...] And when you push too hard, at some point, people lose motivation. To combat this, you have to stay connected to the field."

Most of the companies also mentioned projects postponement:

We wanted to develop Power BI to get sales analytics, but we never did. [...] for continuous improvements projects we are not able to get them implemented.

Organizations strive to maintain operational continuity and efficiency. Nevertheless, project-related activities are often deprioritized, resulting in delays and insufficient attention. One of the companies interviewed is aiming to upgrade its ERP system but has encountered difficulties in recruiting personnel with the necessary expertise, thereby making it necessary to outsource the implementation.

Finally, some interviewees mention lost sales: "Every three to four years, we need to hire someone new. [...]. In the meantime, we have to turn down assignments, as quality requirements must always take precedence over quantity."

These results confirm that the shortage of qualified personnel in the SC has concrete and multifaceted impacts on Swiss companies.

Solutions to labor-shortage

The solutions implemented to address the labor shortage are primarily continuing education, active recruitment on the domestic market, programs to attract young talent, active recruitment on the international market, and process automation.

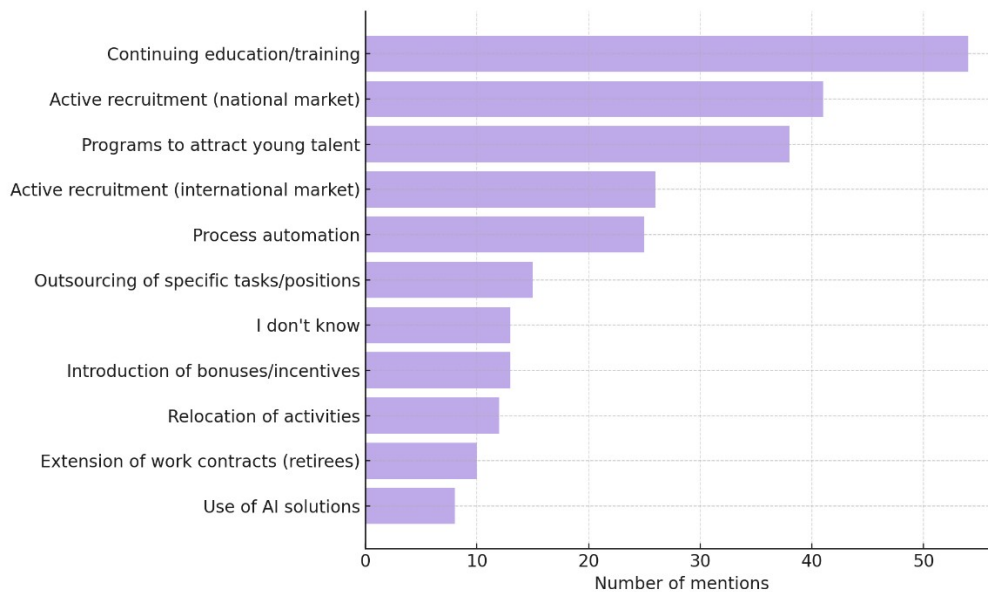


Figure 8. Solutions to skilled labor shortage (personal elaboration based on the results of the questionnaire)

The companies asserted that they have made substantial investments and placed a strong emphasis on ongoing training, as this approach is essential for maintaining the competencies that are indispensable in this field. One company has developed an internal training program designed to enhance its employees' skills. Furthermore, one interviewee mentioned that the relationship between universities and businesses should be strengthened, particularly in the domain of SCM. Other solutions, such as outsourcing certain tasks or positions, introducing bonuses or incentives, offshoring, or extending employment contracts (for people who have reached retirement age), have also been used, but to a lesser extent. One company mentioned that:

The solution we chose was to live with this constraint. In fact, we tried hard to find people, but we couldn't. Now, pragmatically, we're going to adapt [...]. We've set up a network of skills and created partnerships with companies that do the same work as us to take on certain tasks that are highly specialized, which takes the pressure off us at those times [...]. We subcontract, as standard practice, projects or parts of projects.

Some interviewees assert that automation is imperative for inventory tracking and the dissemination of reminders. For example, one company utilizes an ERP system, though it does not currently employ AI technology. Another company has an operational efficiency department that implements solutions to improve processes, such as automation and sensors. However, the interviewee described these solutions as "artisanal", despite the desire to further develop these aspects.

These measures mentioned above are considered to have a moderate effect (45.5%) on recruitment difficulties. Despite the challenge in recruiting qualified employees, the respondents do not consider the significance of the labor shortage. In fact, 73% of them reported they have no indicators to assess the severity of this shortage.

Despite the potential for AI solutions to deliver substantial benefits, only a limited number of companies have adopted them. In this context, digital transformation, and particularly the adoption of AI, can be promising by enhancing decision-making, optimizing resource allocation, and ultimately building more resilient and robust SC.

Artificial Intelligence

According to Legg & Hutter (2007), two fundamental characteristics must be present for a human or a machine to be considered intelligent. The first characteristic is the ability to carefully choose the optimal actions that lead to success based on a specific goal. The second characteristic is the ability to cope with an environment that is not fully known and a range of possibilities that cannot be fully anticipated, through learning and adaptation.

Artificial Intelligence (AI) refers to the field of study and technology that seeks to design systems capable of replicating or augmenting human intelligence. Building on the characteristics outlined by Legg and Hutter, AI encompasses methods that enable machines to make goal-directed decisions and to adapt in uncertain, dynamic environments. Modern AI integrates techniques from computer science, mathematics, and cognitive science to develop models that can learn from data, recognize patterns, and improve performance over time.

While the scientific community defines Artificial Intelligence (AI) in terms of adaptive, goal-oriented decision-making, the public often interprets the term more narrowly through the lens of familiar applications. For many non-experts, AI is closely associated with conversational systems such as ChatGPT, voice assistants, or other visible technologies, rather than the broader set of computational methods and theories. In this study, no formal definition of AI was provided to participants, leaving room for their individual perceptions and interpretations of what counts as AI.

Current State of AI Adoption

The adoption of artificial intelligence in SCM is currently uneven, with companies at varying stages of implementation. 37% of companies reported that they are currently using AI, while 33% are in the evaluation phase and 29% have not yet initiated any steps. Certain sectors, such as commerce, show a higher level of adoption, whereas others, like manufacturing, appear to be less advanced in this regard (Figure 9).

Use of AI by Industry Sector

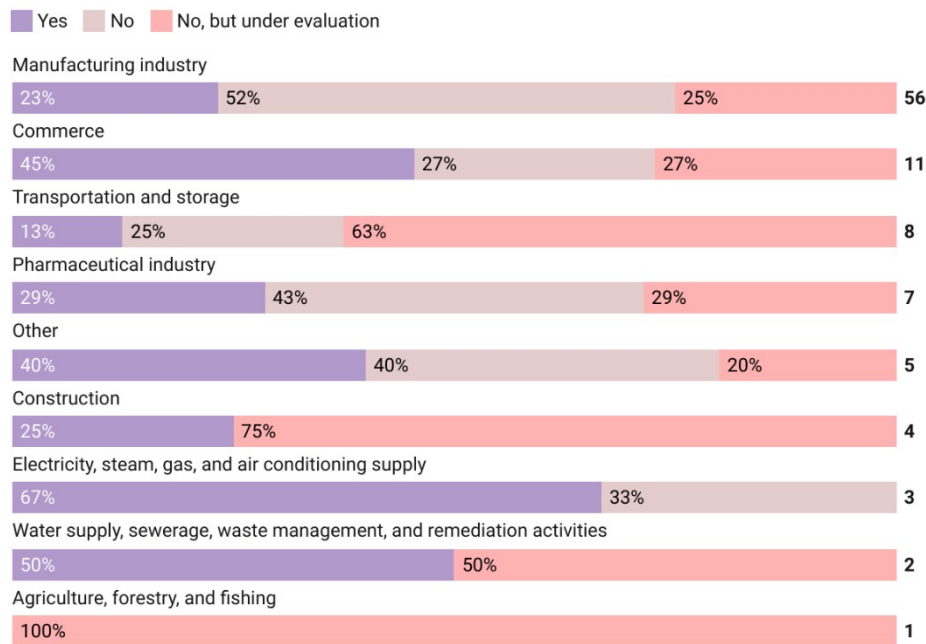


Figure 9. Use of AI by industry (personal elaboration based on the results of the questionnaire)

Within the AI technologies currently used within companies SCM, the most cited are generative IA, followed by algorithmic optimization and ML. There are relatively similar results for the AI technologies currently under evaluation by the companies (Figure 10).

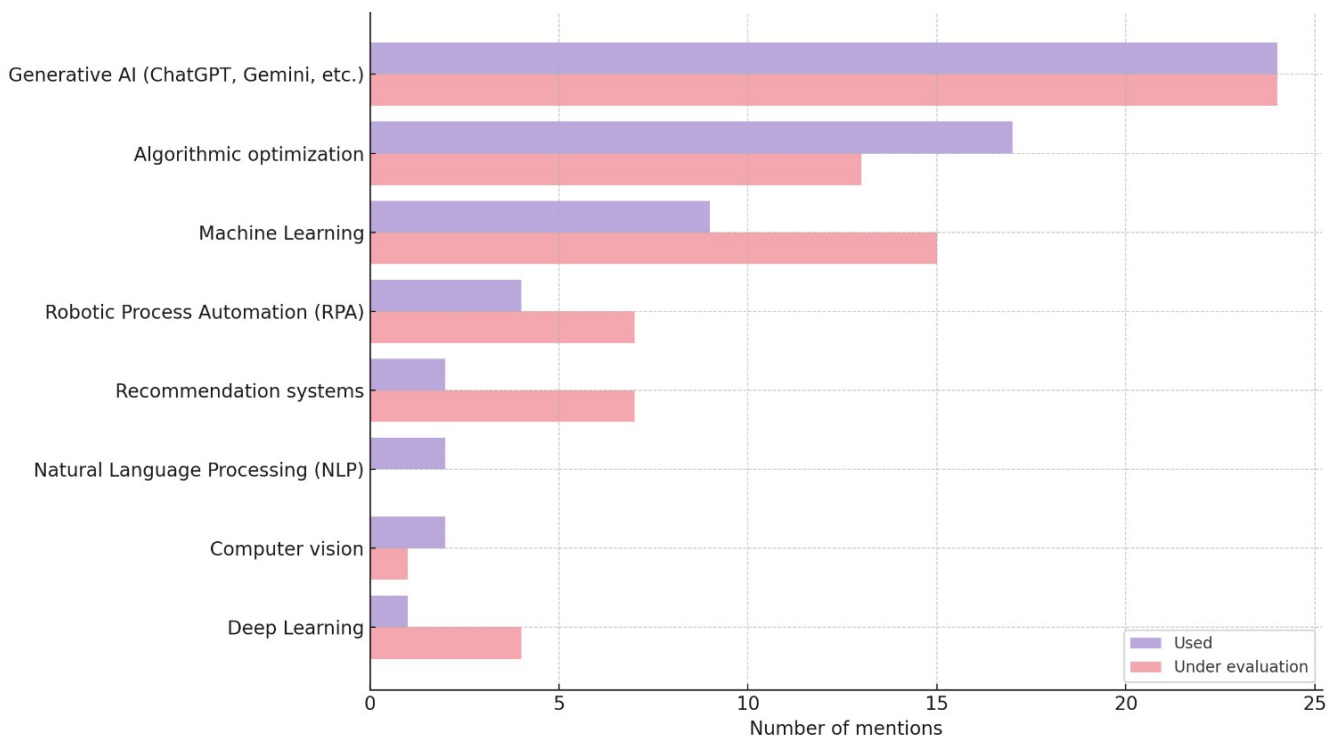


Figure 10. AI technologies used or under evaluation (personal elaboration based on the results of the questionnaire)

Those technologies are primarily used, or under evaluation, for data analyses for decision-making and demand forecasting (Figure 11). This is in line with the type of positions for which companies have the most difficulty recruiting qualified personnel, which are mainly in "Planning" functions (Barriers to AI adoption).

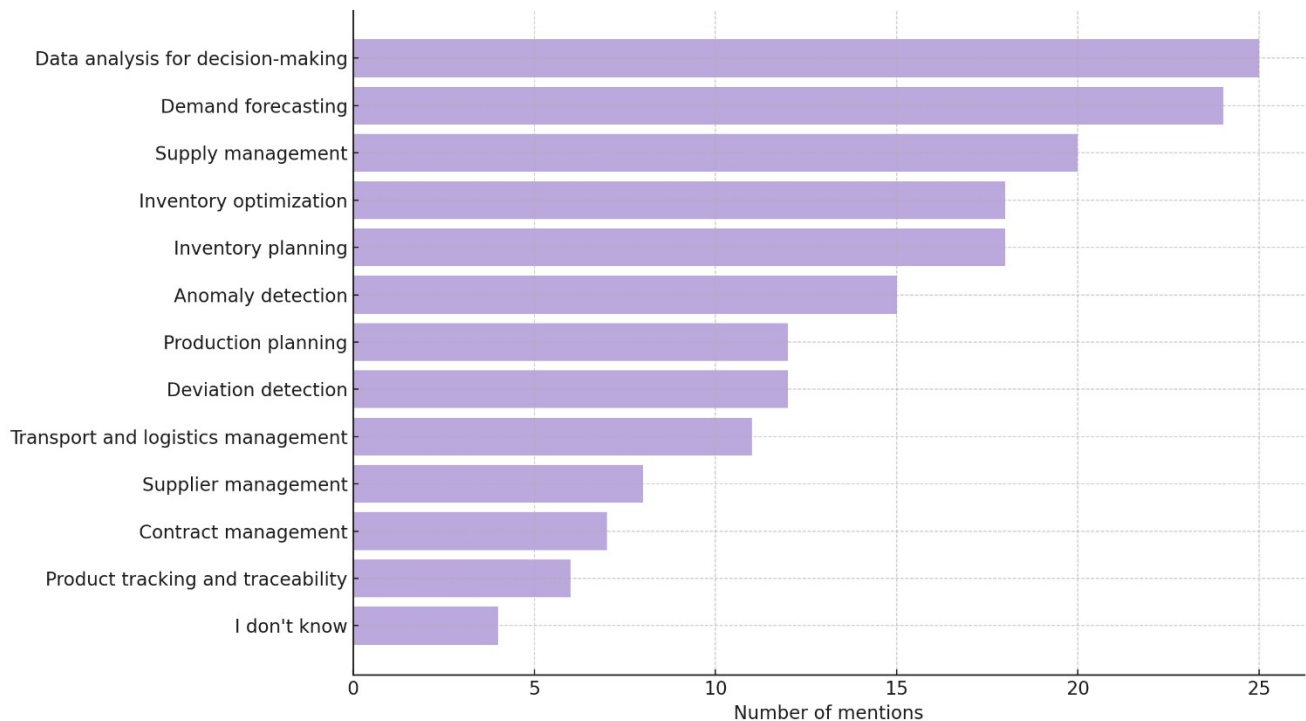


Figure 11. Areas in which AI is used or is currently being (personal elaboration based on the results of the questionnaire)

Barriers to AI adoption

Despite the growing interest in AI solutions, certain barriers remain. As it is a relatively recent development, it is still difficult to find qualified people to implement this type of solution, especially in the specific context of SCM. There is a lack of clear vision on use cases: "I am a little skeptical [...]. I find it difficult to see exactly what the focus could be in the supply chain." Adopting AI requires learning to work with new project management systems, implementing them effectively, and coordinating with developers and interfaces. Organizations often face the challenge of lacking the necessary in-house expertise to initiate such changes or needing to upskill their workforce.

Another significant barrier identified is change management. Successful AI implementation requires effective organizational practices and well-structured development processes (Hangl et al., 2022), a point echoed by one interviewee:

People are generally afraid of seeing their work change when it's something they've mastered. You also have to accept that your job description will be different, that certain parts of your tasks will be automated, so you have to accept that first.

Cultural resistance was also highlighted by one interviewee, who emphasized that the company strongly promotes craftsmanship, showcasing artisans at events and valuing their expertise. This stands in opposition to the notion of AI, where there may be a perception that artisans will be replaced by machines.

Furthermore, developing AI solutions is a significant investment. For the moment, an interviewed company mainly intends to integrate it into the sales side, not yet into the SC, even though the interviewee would like to. The size of the company is once again important, according to the interviewee. Being a small organization, it cannot afford to make too large investment, which is why this company wants to start small. The interviewee also cited a management decision not to invest in AI for the SC, over which he has no control at his level of responsibility.

Even if some are enthusiastic about the usefulness of AI, they feel a little guilty about using it because of environmental considerations:

Sometimes, for silly things, I have a session with someone and I don't feel very prepared, so I ask [the AI]: 'What do you think about this?'. But then I think every time that I'm wasting water, right? I have this image in my head.

Results from the online survey confirm these mixed perceptions. Two-thirds (66%) of respondents do not consider AI a threat to employment in the SC, while a quarter (25%) see it as a potential risk, and 9% expressed no opinion. Some respondents nevertheless noted a fear among staff of being replaced by AI. Artificial Intelligence is still seen as unreliable, and the conclusions drawn from it are often questioned by employees: "Putting myself in the hands of AI, without checking behind it, is complicated for me. [...] Humans must make the difference."

Finally, security and privacy issues compounded by the absence of clear regulatory frameworks governing data use, are major concerns as also highlighted by interviewed companies (Hangl et al., 2022).

These factors may explain the low adoption of AI solutions amongst the companies surveyed.

Impact of AI on recruitment difficulties

In response to the question, "Have AI solutions helped reduce the difficulties in recruiting qualified personnel?", the majority of respondents (73.8%) answered that this was not applicable to their situation. This result suggests that AI solutions are either not yet widely implemented within their organizations as seen in the previous sections or not sufficiently known to be assessed. Among those who provided an assessment, the majority expressed uncertainty (7.8%) or considered the impact of AI on reducing recruitment difficulties to be limited (6.8% moderately; 4.9% little; 4.9% not at all). Only a very small proportion (1.9%) reported a significant contribution. Overall, these results highlight that AI solutions are still at an early stage of adoption and their perceived impact on alleviating labor shortages remains marginal. However, 65% of the respondents do not believe that using these technologies exacerbates these difficulties.

Even though AI is not yet perceived as a direct response to the labor shortage, there is a statistically significant positive correlation between company size and the perceived impact of AI solutions on reducing recruitment difficulties for qualified personnel, suggesting that larger companies are more likely to report that AI has helped alleviate recruitment challenges.

Furthermore, there appears to be a meaningful relationship between whether employees have received training in the use of AI tools for SCM and the company's intention to expand the use of these tools in the coming years. Companies where staff have already received some form of training are more

likely to consider increasing their use of AI to address workforce shortages, whereas those without training seem less inclined to do so.

Finally, companies that have already adopted AI mostly report plans to expand its use within the next 12 to 36 months. Conversely, those who are not currently using AI tend to be less inclined to adopt it moving forward. This suggests that these companies perceive positive effects, or at least effects, encouraging enough to gradually increase the deployment of such solutions.

While AI is not yet a solution to these challenges, it demonstrates clear potential to alleviate future labor shortages.

AI for Supply Chain Management

The implementation of AI solutions within SCM is a recent field, with few solutions having been deployed to date. For now, the companies interviewed mainly use customized versions of ChatGPT internally. It was noted by several interviewees that AI is beginning to be integrated into the sales and marketing sectors, but that its use remains a project in the SC. AI is seen by the interviewees as repository of information "The company is implementing ChatGPT for certain employees [...] to complete technical files", or "With AI [...] we will be able to directly search for data and information that we don't necessarily have, if there is no one who can train us."

Broader AI solutions are still under study, but AI is perceived as a strong lever to save time, mitigate labor shortages, and enhance resilience:

We have lots of activities, activities that are time-consuming and necessary, but that could easily be automated with AI. Activities that ultimately have little added value but are necessary, nonetheless.

We have a lot of administrative tasks that take up a lot of our time. And I think, yes, it [AI] can make things easier. If we take a concrete example where we have difficulty recruiting on construction sites and so on, and if, on top of that, the foreman still has difficulty filling out reports that take him a lot of time, if that can be done by artificial intelligence. It's a task that will be necessary in the future.

Furthermore, as noted by an interviewee, AI has a strong potential for low-value, high-error tasks, such as final checks to record watch serial numbers for traceability purposes.

Interestingly, another interviewee even described AI as a kind of "companion" in their professional lives, supporting not only decision-making but also the emotional dimension of management:

I use AI every day to help me with management tasks, such as proofreading texts. AI, for me, for example, when you're a manager in my position, can sometimes be a bit lonely. I have AI as someone I can talk to.

While these technologies are currently more common in large companies, interviewees stressed that SMEs should not "miss the boat."

Recommendations

This section provides recommendations for the effective adoption of AI in SCM as a strategy to address labor shortages. The analysis is structured around two complementary perspectives: (1) insights from SC professionals who have begun integrating AI into their operational workflows, and (2) contributions from AI experts focusing on current techniques and technological solutions.

Recommendations for successful adoption

What SC professionals suggest

The interviewees recommend exchanges of best practices between companies. They mention the need for joint inter-company projects to test possible uses of AI in the SC. Companies have to communicate their needs to each other to serve as examples and adapt solutions on a case-by-case basis to encourage the development of AI:

It's about connecting, seeing what other companies are doing, not necessarily competitors. And being open to change, having advisors, exchanging ideas, connecting with other experts. That's how I see the solution. You can't just say that this or that tool is for everyone. No, there are derivatives. It's not for nothing that there are lots of ERP solutions, lots of CRM solutions, lots of different tools tailored to everyone's needs. There is no ultimate solution that exists for everyone.

What AI experts suggest

Data culture & Data readiness (fit-for-purpose)

- Develop an enterprise data culture. Data quality is key. The principle "garbage in, garbage out" is well known in AI and machine learning. Developing a strong data culture aiming to improve data management and quality is therefore crucial for companies and industries working with AI-related applications.
- Prioritize a small number of fit-for-purpose data products that are directly aligned with top business pain points (e.g., demand history, lead times, inventory positions, carrier performance), instead of attempting to build lake-wide datasets.
- Clearly define data quality requirements for these products and proactively address data governance and security concerns such as access control, auditability, and retention policies.

Governance & business ownership

- Name an executive sponsor in Operations/Supply Chain with a cross-functional steering group (Ops, IT/OT, HR/L&D, Legal/Compliance). This counters fragmented ownership—highlighted by unclear AI vision in interviews—and anchors AI to real SC outcomes.
- Establish a human-in-the-loop policy for each use case, specifying who reviews decisions, at what stage, and based on what evidence. This directly addresses employee skepticism regarding system reliability and concerns about job displacement.
- Implement ethics and risk guardrails, including systematic bias testing (e.g., in staffing or scheduling), decision logs, and documented fallback or manual override procedures.

Process & role redesign

- Decide early on the role of AI in each use case, whether tasks will be fully automated, provide recommendations, or deliver explanations to support human decisions. This reflects the automation/augmentation/assistance typology and clarifies expectations from the start.

- Log critical decision points within processes (e.g., setting safety stock levels, expediting purchase orders, or reassigning dock slots). Such records are highly valuable for improving AI systems and are often difficult, if not impossible, to reconstruct retrospectively.

People, skills & change management

- Promote lifelong learning through targeted micro-learning programs, focusing especially on hard-to-fill roles. Priority topics include AI fundamentals, effective prompt patterns, exception handling, interpretation of forecasts, and the basics of data trust.

Pilot-to-scale playbook

- Follow a structured pathway: start with a clear value hypothesis, run an 8–12 week pilot, apply an ROI/quality gate, and then move to industrialization. Prioritize domains where data is already available and labor shortages are most acute (e.g., demand/supply planning, stock control).
- Begin in “shadow mode”, where AI generates recommendations, but humans retain decision authority, to build confidence and validate reliability.

Measurement

- Address the current “no indicators” gap by implementing tailored dashboards that track AI performance over time. Since environmental changes can directly affect system outcomes, define clear KPIs to monitor how AI solutions evolve and adapt within your operating context.

Recommendations for application domain and development strategies

What SC professionals expect from AI

Several potential applications were identified by the interviewees across different SC and business functions:

- 1) Inventory management and forecasting
 - AI could support replenishment process, for example by calculating reorder points and safety stock levels, creating alerts in case of shortages of critical products that could halt production for months.
 - Clients of the interviewed companies are already using machine learning, particularly for stock management and warehouse automation, sometimes running "dark warehouses" with minimal human staff.
 - Predictive capabilities could also help anticipate peak demand periods (e.g., before holiday seasons).
 - Companies see value in sales forecasting, managing stocks, and proposing planning scenarios through AI-driven simulations.
- 2) Customer service and after-sales
 - Interest was expressed in developing conversational AI tools for after-sales services, particularly for handling returns.
 - AI could also be used to automate communications such as emails to inform customers about changes in repair timelines.
- 3) Decision-making and risk management
 - AI could act as a "directional aid" above the SC by prioritizing payments, anticipating cascading effects, and preventing operational bottlenecks.
 - Applications were mentioned to prevent human errors (e.g., incorrect labeling, sending wrong products to subcontractors).

- AI is also seen as a tool for analyzing sales data and identifying items requiring urgent attention, moving beyond traditional Excel-based methods.
 - AI is also considered key in optimizing international transport in uncertain contexts (e.g., geopolitical crises, canal disruptions).
- 4) Procurement and supplier management
- AI could support purchasing processes by identifying the best suppliers for various materials, a practice already observed in other firms.
 - Similar tools could be applied to selecting logistics providers and optimizing transport solutions.
- 5) Process automation and operational efficiency
- Companies are exploring automation of transport orders (import/export).
 - The potential of machine learning is recognized for production process optimization, while generative AI could support chatbots for HR or customer interactions.
 - Repetitive tasks and data-driven decision-making are considered prime areas where AI can reduce time spent on low-value activities and compensate for missing skills.

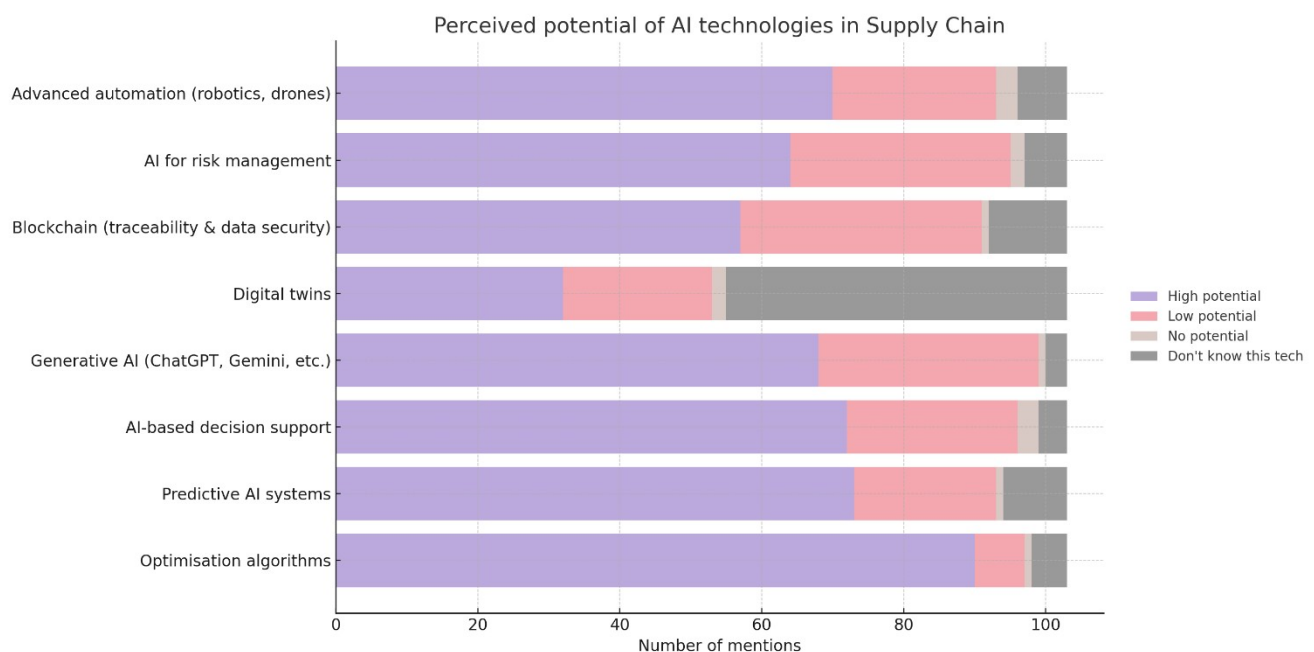


Figure 12. Perceived potential of AI technologies in Supply Chain (personal elaboration based on the results of the questionnaire)

What AI experts suggest

Table 1 below presents a structured mapping of AI techniques applicable to key roles across the SC. For each role–technique pair, a check mark (ü) indicates cases where AI is deemed potentially relevant, namely to improve operational efficiency, shorten lead times, deepen analysis, or strengthen forecasting capabilities.

Taken together, the table provides a synthesis of available technologies and their domains of application by role. Active cells link to an appendix that details the selected solution and the expected benefits.

Table 1. Mapping of AI techniques applicable to key roles across the SC. Some examples of application for the specific job family and techniques are available in the Appendix II (directly reachable by clicking on the checkmark). Note: the growing capabilities of GenAI (generative AI) tools are very promising in almost all job families. Below, the column “Natural Language Processing” is highlighted only for the well-established applications.

Job Family	Job Title	Big Data Analytics	Deep & Machine Learning	Expert Systems	Fuzzy Logic	Meta-heuristics - Genetic Algorithms	Multi-Agent Systems	Natural Language Processing	Simulation
Logistics & distribution operations	Distribution Manager		✓						
Logistics & distribution operations	Fleet Manager / Fleet Dispatcher / Coordinator		✓			✓			
Logistics & distribution operations	Import / Export Specialist		✓						
Logistics & distribution operations	Inventory Clerk		✓						
Logistics & distribution operations	Logistics Analyst	✓	✓			✓			✓
Logistics & distribution operations	Logistics Site Manager		✓						
Logistics & distribution operations	Transport Specialist		✓						
Logistics & distribution operations	Warehouse Manager		✓						
Master data & systems management	SCM Software Implementation Specialist		✓						
Network design &	Network Design	✓	✓			✓			✓

capacity planning	Analyst								
Procurement & supplier management	Procurement Manager	✓	✓	✓	✓	✓	✓	✓	
Procurement & supplier management	Buyer		✓						
Production & manufacturing operations	Operations Manager	✓	✓	✓	✓	✓	✓	✓	✓
Production & manufacturing operations	Production Scheduler		✓			✓			
Reverse logistics & after-sales	Reverse Logistics Manager		✓			✓			✓
Supply chain management & coordination	Supply Chain Director	✓	✓		✓		✓	✓	
Supply chain management & coordination	Supply Chain Manager	✓	✓	✓	✓	✓	✓	✓	✓
Supply chain planning & analytics	Demand Planner	✓	✓		✓	✓		✓	
Supply chain planning & analytics	Inventory Control Manager		✓	✓	✓	✓	✓		
Supply chain planning & analytics	Supply Planner	✓	✓	✓		✓	✓		
Sustainability risk & compliance	Customs Compliance Officer		✓					✓	
Sustainability	Sustainability /	✓	✓		✓			✓	

risk & compliance	CSR Supply Chain Manager								
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Start with high-feasibility, high-impact use cases in those domains, then expand. Follow some examples of use cases in different application domains.

Demand & Supply Planning / S&OP

- Use cases: demand sensing & forecasting; inventory parameter tuning (safety stock, MOQ, reorder points) and supply planning what-ifs.
- How to implement (first 90 days):
 - Pick a product family/market with adequate history (again, data readiness is key).
 - Build a baseline with clear KPIs and metrics.
 - Run shadow forecasts.
 - Open the black box: enable explainability and interpretability modules (those are AI tools that you can use to help explain on which bases an AI comes up with a decision/result).
 - Move to a more automatic solution (behind approval gates).
 - KPIs: MAPE (Mean Absolute Percentage Error), service level (KPI that measures the ability to meet customer demand without stockouts), stockouts, working capital, planner hours per cycle.
- Rationale: aligns to existing demand-forecasting focus and planning skill shortages.

Procurement & Supplier Management

- Use cases: purchase order exception automation (detect and resolve anomalies in purchase orders without manual intervention), formal & technical documentation drafting, contract clause extraction, supplier risk sensing (e.g., delivery performance, quality signals).
- How:
 - Create your learning dataset (historical data, positive and negative cases).
 - Evaluate data confidentiality (is the use of APIs such as OpenAI's or Google's acceptable? Or do you need a private, on-premises solution?).
 - Connect to approved content for retrieval-augmented answers.
 - Define acceptance rules and human review strategies.
 - Implement the AI model (based, for instance, on Large Language Models).
- KPIs (dependent on the use case): Cycle time, exceptions auto-resolved, rework rate, supplier OTIF (On-Time In-Full), buyer workload, etc.
- Rationale: procurement is a top-difficulty role; repetitive admin can be offloaded to increase attractiveness.

Warehousing & Fulfillment

- Use cases: slotting optimization, dynamic pick paths, wave/labor scheduling, counting/damage detection, safety alerts; later, autonomous robots' orchestration.
- How:
 - Reduce complexity. Start in one, high-priority zone or process (e.g., high-velocity picks).
 - Create and run a digital twin or a simulation of your environment. Validate your approach in the simulated environment before deploying in the real scenario.
- KPIs (dependent on the use case): Picks/hour, pick accuracy, injuries/near-misses, onboarding time, overtime, etc.

- Rationale: interviews cite automation potential for repetitive intralogistics tasks; some client sites already pursue "dark warehouse" concepts.

Transportation

- Use cases: dynamic routing & tendering, ETA (Estimated Time of Arrival) prediction, dock/yard optimization, freight-audit anomaly detection.
- How:
 - Pilot on a subset of lanes.
 - Compare planned vs. actual cost/service.
 - Implement dock scheduling with simple rules before ML optimization.
- KPIs: on-time delivery, cost per shipment, detention/dwell¹, emissions proxy, dispatcher workload, etc.
- Rationale: initial focus on prediction and visibility creates a foundation for advanced optimization.

Order Management & Customer Service

- Use cases: Intelligent order capture (OCR/NLP), ATP (Available to Promise) and CTP (Capable to Promise) accuracy, claims triage, multilingual chat assistants for after-sales (returns status, repairs ETA).
- How
 - Launch a service copilot with retrieval over policies/SOPs.
 - Allow templated emails for proactive delay notifications (a desire mentioned by interviewees).
- KPIs: enhances responsiveness and reduces manual workload in customer-facing processes.

Quality, Compliance & Sustainability

- Use cases: traceability checks, deviation detection, and document parsing for regulatory filings; optionally blockchain for high-value serials (e.g., watch anti-theft traceability).
- How:
 - Start with retrieval-augmented QA on approved corpora.
 - Add serial-number registry integration for specific luxury flows (highlighted by interviewees).
- KPIs: deviations caught, audit lead time, counterfeit/return incidents.

¹ Dwell time refers to the total amount of time spent at the facility, while detention is any time spent waiting to be loaded or unloaded.

Opportunities for workforce and job attractiveness

Which opportunities and limits SC professionals identify

AI solutions make SC jobs more attractive, according to 56.3% of respondents. This is further confirmed by the semi-structured interviews. Some interviewees see potential in this area with the automation of the most basic and repetitive tasks, leaving more room for more stimulating tasks that require thought, making SC jobs more attractive, but finds that it will take a long time to get there:

There is a change coming. We don't know what it will be. And we have to deal with it. But it will create opportunities. I see it as positive. I see the opportunity side of it. It will allow us to reorient ourselves and perhaps [...] enable all those jobs that had low added value because they were very repetitive [...] to do work that is more meaningful.

We are now working on this new tool for sales forecasting, but the person in charge spends two to three days just checking that the data we have imported is correct. Whereas they could spend those three days analyzing loan quality and defining action plans based on that. In short, we need to focus our energy on the right place.

What AI experts suggest

Make jobs better, not just faster

- Automate the necessary and repetitive tasks first (report compilation, basic data entry and data validation).
- Re-scope roles toward exception management, scenario planning, supplier collaboration, and customer-facing problem-solving where the human sensibility is still key.

Continuous learning & Faster onboarding

- Propose (continuous) education to train and keep employee's knowledge up to date.
- Provide an in-house Supply Chain "Copilot" that explains systems, data fields, standard and operations procedures, and "how to" steps, addressing the language hurdle and shortening time-to-competence.

Purpose & sustainability

- Acknowledge environmental concerns about AI; adopt model efficiency guidelines and report net impact (time saved, errors prevented) alongside energy use.

Talent pipeline & visibility

- Form academics - industry partnerships to create role-specific labs and activities (planning/warehouse/transport) and increase the visibility of your industry to the future talents.

Conclusions & perspectives

The findings of this white paper underscore the multifactorial nature of labor shortages in supply chain (SC) professions in Switzerland, revealing both structural and episodic causes. The shortage affects a wide range of roles—from planning and procurement to logistics and analytics—and is exacerbated by demographic shifts, evolving employee expectations, and the limited attractiveness of SC careers. The consequences are tangible: work overload, project delays, diminished innovation capacity, and reduced competitiveness.

Artificial intelligence (AI) emerges as a promising, albeit underutilized, lever to address these challenges. While adoption remains nascent, particularly among small and medium-sized enterprises (SMEs), early implementations suggest that AI can contribute to labor resilience by automating low-value tasks, facilitating decision-making, and enhancing job attractiveness. The potential applications span the whole supply chain.

However, the deployment of AI in SC functions is contingent upon several critical success factors:

Organizational readiness, including digital infrastructure and managerial commitment.

- Workforce upskilling, to ensure meaningful human–AI collaboration and the selection of the right solution for a specific task.
- Ethical and inclusive practices, to mitigate fears of job displacement and ensure responsible AI use.
- Inter-company collaboration, to share best practices and co-develop tailored solutions.

Looking forward, the perspectives for AI in SC are promising but require strategic alignment. Companies must move beyond pilot projects and isolated use cases to develop integrated AI strategies that are responsive to their operational realities and human capital needs. Public–private partnerships, targeted funding, and academic–industry collaboration will be essential to accelerate adoption and ensure equitable access to AI technologies.

In conclusion, AI should not be viewed as an out-of-the-box solution but as a strategic enabler within a broader transformation agenda.

By fostering labor-resilient supply chains—capable of adapting to workforce constraints through intelligent automation and human-centered innovation—Swiss companies can enhance their competitiveness and contribute to a more sustainable and inclusive economic model.

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Appendix I. Overview of Interviewed Companies and Participants

Number	Company Description All the companies are based in Switzerland and have a national or international reach.	Interviewee Information
1	The company is one the leading actors in the Swiss retail sector.	The interviewee is an IT specialist (with CFC training) and started in logistics before becoming head of distribution of the company.
2	The company was founded by the interviewee. It is active in consulting and engineering in logistics and supply chain management.	The interviewee is a production logistics engineer with experience in the pharmaceutical sector. The interview founded a consulting company and also teaches classes at a university of applied sciences.
3	The company is a wholesaler of building materials for structural work and interior finishing. It is part of a European group in the sector.	The interviewee holds a federal certificate in logistics and is currently a supply chain project manager within the company.
4	The company is active in wholesale distribution of food products in Switzerland.	The interviewee is trained as a logistics specialist and holds a certificate in purchasing and procurement, as well as a DAS (Diploma of Advanced Studies). The interviewee is responsible for the company's food procurement.
5	The company is active in the watchmaking sector, having set itself apart by integrating e-commerce into the field of watchmaking.	The interviewee holds a bachelor's degree in supply chain management and is currently working as a supply chain manager.
6	The company is a global non-profit organization that develops and maintains supply chain standards, such as barcodes and product identifiers.	The interviewee holds a Master's degree and works as a logistics partnerships manager.
7	The company is a global leader in the manufacture of turned contacts and spring connectors for aerospace and other industrial applications.	The interviewee holds a federal certificate in management & leadership and works as supply chain director at the company.
8	The company manufactures precision cutting tools made of solid carbide, diamond, shaped tools, and precision reamers for watchmaking, medical, bar turning, aeronautics and automotive industry.	The interviewee holds a certificate of advanced studies in supply chain management and works as a supply chain manager at the company.
9	The company supports multi-energy infrastructure players and specializes in supply chain management for energy networks.	The interviewee has worked in several different companies as a logistics and supply chain manager and is responsible for continuous improvement projects at the company.
10	It is an international company in the luxury sector, active in leather goods, fashion, accessories, and fragrances.	The interviewee holds a Master of Science and is supply chain distribution manager for the company.

Appendix II. Correspondences between professions in SC and AI tools

Job Family	Supply Chain Job Role	Associated AI Techniques	Specific Applications & Solutions
Logistics & distribution operations	Distribution Manager	Deep & Machine Learning	Improves distribution planning and delivery efficiency through accurate forecasts.
Logistics & distribution operations	Fleet Manager / Fleet Dispatcher/Coordinator	Deep & Machine Learning	Implements predictive maintenance for vehicles, reducing downtime. Optimizes fleet utilization and real-time routing.
		Metaheuristics - Genetic Algorithms	Optimizes vehicle planning and resource management.
Logistics & distribution operations	Import/Export Specialist	Deep & Machine Learning	Assesses risks in international supply chains using predictive analytics.
Logistics & distribution operations	Inventory Clerk	Deep & Machine Learning	Benefits from automation of stock tracking and error reduction.
Logistics & distribution operations	Logistics Analyst	Big Data Analytics	Performs in-depth analysis of complex datasets to generate actionable insights.
		Deep & Machine Learning	Analyzes data for routing optimization, demand forecasting, and performance assessment.
		Metaheuristics - Genetic Algorithms	Analyzes data for complex optimization problems in logistics and SCM.
		Simulation	Performs in-depth performance analyses using simulation models.
Logistics & distribution operations	Logistics Site Manager	Deep & Machine Learning	Uses predictive data for better on-site operations planning, similar to the warehouse manager.
Logistics & distribution operations	Transport Specialist	Deep & Machine Learning	Optimizes transport schedules and manages disruptions.
Logistics & distribution operations	Warehouse Manager	Deep & Machine Learning	Optimizes stock levels and layout via accurate forecasts. Automates warehouse tasks through AI-assisted robotics.
Master data & systems management	SCM Software Implementation Specialist	Deep & Machine Learning	Integrates Deep & Machine Learning algorithms into existing SCM systems and develops software solutions.
Network design & capacity planning	Network Design Analyst	Big Data Analytics	Uses Big Data Analytics insights to optimize facility location and network design.
		Deep & Machine Learning	Optimizes supply chain network design.
		Metaheuristics - Genetic Algorithms	Designs optimal supply chain networks, including facility location and routing.
		Simulation	Uses simulation to design optimal

			supply chain networks and test resilience.
Procurement & supplier management	Procurement Manager	Big Data Analytics	Improves supplier selection through deep analysis of spend and performance data.
		Deep & Machine Learning	Selects more reliable suppliers by predicting performance and risks. Manages supplier risks through predictive analytics.
		Expert Systems	Makes informed decisions for selecting Third-Party Logistics Providers (3PL) and other partners.
		Fuzzy Logic	Evaluates and selects suppliers while accounting for subjective criteria and the fuzzy nature of information.
		Metaheuristics - Genetic Algorithms	Improves supplier selection, especially for complex or multi-objective criteria.
		Multi-Agent Systems	Engages in negotiation models with suppliers for better collaboration.
		Natural Language Processing	Uses chatbots to digitize supplier interactions and automate conversations. Analyzes market trends and sustainability risks from textual sources.
Procurement & supplier management	Buyer	Deep & Machine Learning	Uses predictive insights on suppliers and markets for negotiations.
Production & manufacturing operations	Operations Manager	Big Data Analytics	Uses Big Data Analytics insights to optimize operational processes and stock levels.
		Deep & Machine Learning	Optimizes production schedules and process control through predictive analytics. Enhances asset management through predictive maintenance.
		Expert Systems	Uses expert systems for production planning and scheduling.
		Fuzzy Logic	Improves decision making in manufacturing systems with uncertain data.
		Metaheuristics - Genetic Algorithms	Optimizes production planning, scheduling, and resource allocation.
		Multi-Agent Systems	Manages integrated production and self-learning manufacturing systems.
		Natural Language Processing	Monitors processes and equipment through speech recognition; Processes and understands operational data for predictive maintenance.

		Simulation	Models and optimizes operational processes, including responsiveness.
Production & manufacturing operations	Production Scheduler	Deep & Machine Learning	Uses AI-based production forecasting systems for scheduling.
		Metaheuristics - Genetic Algorithms	Uses GA-optimized production schedules.
Reverse logistics & after-sales	Reverse Logistics Manager	Deep & Machine Learning	Forecasts returns and assesses condition (e.g., remanufacturability) using DL (computer vision). Optimizes recovery and returns management processes. Automatically assesses damage and remanufacturability of returned products using vision (CNN) systems.
		Metaheuristics - Genetic Algorithms	Optimizes reverse logistics networks and processes.
		Simulation	Simulates scenarios to optimize reverse logistics processes.
Supply chain management & coordination	Supply Chain Director	Big Data Analytics	Develops strategies to leverage Big Data Analytics for resilience and innovative capabilities. Makes strategic decisions on facility location, stock levels, and distribution.
		Deep & Machine Learning	Develops strategies to integrate AI/ML for competitive advantage and resilience. Leads supply chain innovation via Deep & Machine Learning capabilities.
		Fuzzy Logic	Develops strategies to manage uncertainty across the supply chain.
		Multi-Agent Systems	Oversees implementation of agent-based architectures for strategic planning and resilience.
		Natural Language Processing	Uses Natural Language Processing to understand the supply chain landscape and make strategic decisions about risks and opportunities.
Supply chain management & coordination	Supply Chain Manager	Big Data Analytics	Makes data-informed decisions for risk management and resilience. Improves operational visibility and transparency.
		Deep & Machine Learning	Makes better-informed decisions via accurate demand forecasts and risk analytics. Optimizes overall supply chain efficiency. Improves resilience by anticipating and mitigating disruptions.
		Expert Systems	Benefits from recommendations for

			complex decisions, reducing decision time and improving quality.
		Fuzzy Logic	Makes more robust decisions under uncertainty and imprecise data.
		Metaheuristics - Genetic Algorithms	Makes optimal decisions for network design, planning, and inventory management. Improves supply chain efficiency through process optimization.
		Multi-Agent Systems	Analyzes complex supply chain behaviours and makes decisions for better coordination.
		Natural Language Processing	Gains real-time insights on operational challenges, risks, and market trends from unstructured sources; Monitors operations via voice or visual interfaces.
		Simulation	Evaluates scenarios for supply chain design, planning, and scheduling. Understands supply chain dynamics to support strategic decisions.
Supply chain planning & analytics	Demand Planner	Big Data Analytics	Relies on Big Data Analytics for accurate forecasts and stock planning.
		Deep & Machine Learning	Builds highly accurate demand forecasts using Deep & Machine Learning models. Develops more reliable demand scenarios.
		Fuzzy Logic	Generates more nuanced demand forecasts by integrating qualitative or uncertain information.
		Metaheuristics - Genetic Algorithms	Contributes to optimizing pricing and production policies based on forecasting.
		Natural Language Processing	Analyzes customer preferences and market trends from textual data to refine forecasts.
Supply chain planning & analytics	Inventory Control Manager	Deep & Machine Learning	Optimizes inventory levels and reduces bullwhip effects via advanced demand forecasting.
		Expert Systems	Manages multi-echelon inventory control with the help of Expert Systems.
		Fuzzy Logic	Manages stock and demand forecasts under fuzzy or uncertain data.
		Metaheuristics - Genetic Algorithms	Optimizes order levels and economic order quantities (EOQ).
		Multi-Agent Systems	Optimizes inventory management in distributed, complex

			environments.
Supply chain planning & analytics	Supply Planner	Big Data Analytics	Integrates Big Data Analytics insights for optimal production and capacity planning.
		Deep & Machine Learning	Makes more accurate production and capacity planning decisions based on demand forecasts.
		Expert Systems	Uses expert systems to refine production planning.
		Metaheuristics - Genetic Algorithms	Optimizes production planning strategies.
		Multi-Agent Systems	Improves distributed planning and the ability to react quickly to changes.
Sustainability, risk & compliance	Customs Compliance Officer	Deep & Machine Learning	Uses predictive analytics to identify non-compliance risks in shipments.
		Natural Language Processing	Processes and analyzes documents for customs compliance (Natural Language Processing potential for document-reading automation).
Sustainability, risk & compliance	Sustainability / CSR Supply Chain Manager	Big Data Analytics	Benefits from improved visibility on supply chain data for sustainable practices.
		Deep & Machine Learning	Assesses and selects "green" suppliers using data-driven models. Monitors suppliers' environmental performance.
		Fuzzy Logic	Assesses sustainable suppliers by integrating qualitative and subjective factors.
		Natural Language Processing	Monitors sustainability risks by analyzing textual data from social media and news.