

Decoding The Modern Supply Chain Management Professional: The Industry's Voice

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NOTICE: This is the peer reviewed version of the following article: Enstroem, R., Singh Kang, P., & Bhawna, B. (2025). Decoding the modern supply chain management professional: The industry's voice. *Journal of Management Development*, 44(4), 514-533. <https://doi.org/10.1108/JMD-04-2024-0134>. This author accepted manuscript is provided for your own personal use only. It may not be used for resale, reprinting, systematic distribution, emailing, or for any other commercial purpose without the permission of the publisher. This author accepted manuscript is deposited under a Creative Commons Attribution Non-commercial 4.0 International (CC BY-NC) licence. This means that anyone may distribute, adapt, and build upon the work for non-commercial purposes, subject to full attribution. If you wish to use this manuscript for commercial purposes, please contact permissions@emerald.com.

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Journal:	<i>Journal of Management Development</i>
Manuscript ID	JMD-04-2024-0134.R2
Manuscript Type:	Original Article
Keywords:	Supply chain management, Skills, Job descriptions, Workforce, Competencies

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Purpose: This study examines the evolving nature of supply chain management (SCM) in response to increasing complexity and the expanding scope of competencies required of SCM professionals. It lays the groundwork for developing a comprehensive competency framework aligned with current industry needs.

Design/Methodology/Approach: This study combines an extensive literature review with inductive content analysis of web-scraped job advertisements, utilizing unsupervised machine learning models. This approach offers a comprehensive view of SCM's disciplinary scope, professional competencies, and the industry's evolving demands.

Findings: The analysis reveals a structured hierarchy of competencies, reflecting SCM's shift from unifunctional to multifunctional roles. It demonstrates the need for SCM professionals to integrate specialized technical expertise with cross-functional capabilities, highlighting systemic thinking and adaptability in a volatile, uncertain, complex, and ambiguous (VUCA) environment. The analysis shows a strong demand for digital proficiency, data analytics, global awareness, sustainability, risk management, and regulatory compliance.

Originality/Value: This research provides unique insights into the evolving competency landscape of SCM professionals, capturing the field's transition to an integrated, strategic, and technology-driven discipline. It offers a valuable reference point for academics, industry practitioners, human resource managers, and policymakers seeking to align education, training, and workforce development with real-world SCM demands.

Keywords: supply chain management, skills gap, professional competencies, content analysis, job advertisements, workforce development, digital skills

Introduction

The supply chain management (SCM) field is evolving rapidly and placing new demands on professionals. Meeting these demands calls for an extensive and adaptive set of competencies to tackle the simultaneous challenges of globalization, digital transformation, sustainability, and risk management (Nikookar and Yanadori, 2022). The critical role of SCM professionals has traditionally received limited public attention (Shih, 2022), but the COVID-19 pandemic brought supply chain (SC) resilience to the forefront and exposed the complexity of SCM to a wider audience (Sultan, 2022). Anecdotally, the authors also observed a noticeable post-pandemic increase in student interest in SCM.

The public's shifting perception of SCM reflects the field's inherent complexity. SCM lacks a precise definition (Frankel *et al.*, 2008; Swanson *et al.*, 2018), remains contemporary in scope and nomenclature (Lummus and Vokurka, 1999), and is adaptive in nature (Carter *et al.*, 2015). It functions as a multifaceted discipline (Hoberg *et al.*, 2020), encompasses transversal themes (Garcia-Buendia *et al.*, 2021), and engages a broad range of stakeholders across organizations (Ishfaq *et al.*, 2022; Wiedmer and Griffis, 2021). These qualities blur the lines between SCM and traditional business functions (Mentzer *et al.*, 2008), complicating efforts to define the field coherently.

The establishment of standardized SCM practices is complicated by the field's expanding scope and role diversity. Its multifunctional nature requires professionals to develop a comprehensive skill set (Jordan and Bak, 2016), some of which overlap with competencies expected of generalist business graduates (Benson and Enstroem, 2017; Enstroem and Benson, 2024). Yet, without a clear understanding of the field, standardizing and assessing these competencies remains challenging, impacting recruitment, training, and evaluation (McKendrick, 2023). The absence of a common reference framework complicates efforts to establish consistent benchmarks for SCM professionals, creating a tension between adapting to evolving demands and maintaining a coherent professional identity (Swanson *et al.*, 2018). This ambiguity also makes it difficult for SC managers to articulate their roles and contributions in organizations. While SCM's inherent adaptability is a strategic advantage, it also drives continual evolution and places pressure on professional and management development programs to stay current.

SCM has gained increased visibility, but the competencies that employers seek for SCM roles remain underexplored. This study explores SCM as a field with evolving competency requirements and examines its disciplinary origins and professional trajectory through a literature review and topic modelling of web-scraped SCM job advertisements. Specifically, we seek to understand the competencies that the market

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3 expects of SCM professionals. Identifying these competencies and the professional identity employers seek
4 is critical to inform more targeted training and development programs.
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8 We analyze job advertisements as the primary data source to infer SCM competencies in demand. As direct
9 communication channels, job ads provide an unfiltered view of competencies across roles (Napierala,
10 2024). Publicly accessible job advertisements therefore offer real-time insights into employer expectations
11 for SCM competencies. Prior research supports their use in capturing job requirements and competency
12 profiles (Barbosa and Oliveira, 2021; Kim and Angnakoon, 2016). Space constraints also compel employers
13 to articulate only the most prioritized competencies in the current market (Rios *et al.*, 2020). As precursors
14 to employment contracts, job ads establish foundational expectations for SCM roles.
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20 The remainder of the paper is organized as follows. The next section discusses SCM's origins and evolution
21 as a field and profession, which establishes the foundation for the analysis of job advertisements. The
22 subsequent sections present the method and results, followed by a discussion of the implications for
23 requested competencies, professional profiles, and role domains in SCM. Based on these findings, the paper
24 offers recommendations for industry training, management development, and future research. The final
25 section concludes.
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30 31 **The evolutionary path of SCM**

32 Supply Chain Management (SCM) has undergone a profound transformation, shifting from an operational
33 focus on logistics and physical distribution to a strategic, interdisciplinary field embedded in global
34 networks. Concerned initially with procurement, manufacturing, and logistics, SCM now reflects an
35 integrated perspective shaped by global market dynamics (Frederico *et al.*, 2020; Gámez-Pérez *et al.*, 2020;
36 Gammelgaard, 2023).
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41 42 *Historical foundations and early definitions*

43 SCM was largely unfamiliar in the 1950s and 1960s, characterized by slow product development
44 constrained by internal capabilities and purchasing perceived as a production support function (Farmer,
45 1997). Production efficiency was prioritized, with limited sharing of technology and expertise (Tan, 2001).
46 University curricula offered majors in transportation, while logistics, physical distribution, and SCM were
47 largely absent (Southern, 2011). The initial steps toward modern SCM occurred in the 1960s when
48 transportation managers realized that logistics decisions impacted operations. The field further evolved in
49 the 1970s when businesses recognized the value of integrating supply chain functions into their operational
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3 strategies. Companies merged inbound logistics with related activities to streamline processes (Mehmeti,
4 2016).

5 6 7 8 *Transition to integrated SCM*

9 Throughout the 1980s and 1990s, companies faced mounting pressures to improve logistical efficiency by
10 delivering services that were faster, better, and more cost-effective. This demand drove the integration of
11 inbound logistics, linking purchasing, transportation, and inventory control to enhance operational
12 performance. By the late 1990s, firms pursued collaborative logistics to reduce costs and increase efficiency
13 (Stank *et al.*, 1999; Cooper *et al.*, 1997). The adoption of Enterprise Resource Planning (ERP) systems
14 consolidated information flows and strengthened buyer-supplier relationships (Mehmeti, 2016). Integrated
15 SCM shifted focus to value through collaboration and partnership (Carter and Ellram, 2003; Croom *et al.*,
16 2000; Giunipero *et al.*, 2008). By the late 1990s, the term SCM had gained widespread use, though its
17 meaning remained ambiguous (Frankel *et al.*, 2008; Storey *et al.*, 2006).
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25 *SCM in a strategic context*

26 In the early 2000s, digital transformation and globalization established SCM as a strategic discipline.
27 Technologies such as Big Data, the Internet of Things (IoT), Radio Frequency Identification (RFID),
28 Machine Learning (ML), and Artificial Intelligence (AI) reshaped SCM by enhancing decision-making and
29 operational efficiency (Gammelgaard and Larson, 2001). SCM activities became increasingly integrated by
30 the 2000s. At this stage, SCM was recognized for its potential to drive cost savings and customer
31 satisfaction (Ballou, 2007).
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38 During this period, Lean and Six Sigma reinforced efficiency and quality. Concurrently, global expansion—
39 fueled by trade liberalization—broadened the scope of SCM, shifting professional roles from transactional
40 to strategic planning and oversight (Carr and Smeltzer, 2000; Faes *et al.*, 2001; Giunipero *et al.*, 2008;
41 Johnson *et al.*, 1998). As SCM matured, professionals were expected to manage a range of integrated supply
42 chain functions, requiring technical expertise and soft skills (Bak *et al.*, 2019; Cousins *et al.*, 2006; van
43 Hoek, 2002; Vollmann *et al.*, 2004). The evolution into global supply chain management further increased
44 the need for strategic data interpretation and decision-making (Bag *et al.*, 2020; Clegg *et al.*, 2013; Gupta
45 *et al.*, 2019).
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52 *Contemporary SCM: Supply Chain 4.0 and beyond*

53 SCM has embraced the Supply Chain 4.0 paradigm, characterized by automation, robotics, real-time
54 analytics, machine learning, and digital connectivity for enhanced decision-making and business
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3 intelligence (Frederico *et al.*, 2020; Narwane *et al.*, 2021). Supply Chain 4.0 leverages these advancements
4 to increase operational efficiency and agility across global supply chains (Alkaraan *et al.*, 2025; Dubey *et*
5 *al.*, 2021).
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9 The digital transformation requires SCM professionals skilled in data analytics and digital tools to anticipate
10 disruptions and strengthen resilience (Govindan *et al.*, 2022; Narwane *et al.*, 2021). Emerging frameworks,
11 such as maturity models, support organizations in assessing digital readiness and identifying capability gaps
12 across their networks (Frederico *et al.*, 2020; Rios *et al.*, 2020). Given the volatile, uncertain, complex, and
13 ambiguous (VUCA) business environment, agility and strategic flexibility are vital (Enstroem and
14 Schmaltz, 2023). In parallel, behavioural competencies, particularly adaptability and relational skills, have
15 become critical for managing collaboration and navigating technological change. These capabilities
16 underpin success in modern supply chains, where professionals operate across interdependent digital and
17 physical domains (Bak *et al.*, 2019; Fantozzi *et al.*, 2024; Modgil *et al.*, 2023).
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25 As SCM continues to evolve, balancing technological capacity with a human-centric approach becomes
26 critical. The Harmonized Information-Technology and Organizational Performance (HI-TOP) framework
27 addresses this balance by integrating technical and human resources to enhance productivity, facilitate
28 knowledge management, and align information processes with decision-making (Enstroem *et al.*, 2024).
29 Linking data capabilities with strategic decision-making enables SCM professionals to support
30 sustainability and resilience (Alkaraan *et al.*, 2025; Narwane *et al.*, 2021).
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36 *The SCM competence milieu*

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38 The transformation of SCM underscores the need for a skilled workforce (Lutz *et al.*, 2022; Ul Akram *et*
39 *al.*, 2024; Whysall *et al.*, 2019). Addressing talent development and aligning education with industry
40 expectations are critical to sustaining SCM's relevance and impact (Daigle *et al.*, 2023; Lutz *et al.*, 2022;
41 Kotzab *et al.*, 2018). The effectiveness of logistics and SCM increasingly depends on professionals
42 equipped to meet the demands of a dynamic, globally interconnected field (Richey *et al.*, 2022; Rojo *et al.*,
43 2018). Bridging competency gaps requires close collaboration between academia and industry, with work-
44 integrated learning helping to align graduate competencies with evolving industry needs (Gámez-Pérez *et*
45 *al.*, 2020; Enstroem, 2018). Such collaboration supports both technical and relational skill development as
46 SCM roles shift from unifunctional to multifunctional and interfunctional.
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54 As SCM has progressed from isolated functions to a strategic and integrative discipline, competency
55 demands have shifted from siloed expertise to transversal capabilities (Enstroem and Schmaltz, 2024).
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3 Contemporary roles require technical proficiency, systemic thinking, and the ability to operate across
4 functional boundaries (Wang and Enstroem, 2024). In a persistent VUCA environment, SCM professionals
5 further need to demonstrate resilience and adaptability to navigate continuous change (Enstroem and
6 Schmaltz, 2023; “Setting up for success,” 2023). Figure 1 illustrates this competency evolution—from
7 specialized and unifunctional to integrated and relational.
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16 Figure 1. The changing competence requirements of supply chain professionals
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19 **Data and analytical approach**

20 *Data collection and preparation*

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22 Job advertisements were chosen as the primary data source due to their role as publicly accessible, unfiltered
23 job market articulations of current industry demands and expectations for SCM roles. They reflect the
24 prioritized competencies that employers seek from candidates. Using job ads to infer critical competencies
25 is an established method for constructing competency frameworks (Barbosa and Oliveira, 2021; Kim and
26 Angnakoon, 2016; Verma *et al.*, 2019).
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32 Using job advertisements as a data source for competency analysis offers several advantages. First, job ads
33 require employers to specify the skills they deem essential, often due to space constraints, resulting in a
34 prioritized set of competencies that they value in hiring contexts (Herold and Roedenbeck, 2024; Rios *et al.*,
35 2020; Yadav, 2022). Second, the abundance and public availability of job ads allow for a
36 comprehensive, real-world assessment of labour market demands across sectors and job levels. Third, job
37 ads provide an accurate and timely snapshot of labour market needs, especially as most professional roles
38 are posted online (Herold and Roedenbeck, 2024; Rios *et al.*, 2020; Yadav, 2022). While alternative
39 approaches like employer surveys or job analysis can offer insights, they lack the immediacy and specific
40 focus on market-driven competencies that job ads provide (Herold and Roedenbeck, 2024; Rios *et al.*, 2020;
41 Yadav, 2022).
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49 The job ads were scraped from Indeed.com, a leading employment website. A list of 47 distinct job titles
50 was compiled to capture the breadth of roles in SCM. A two-dimensional approach was used to collect the
51 data, based on (a) the traditional pillars of SCM—procurement, production, inventory management,
52 distribution, and logistics (Ballou, 2007)—and (b) the range of managerial responsibilities, from entry-level
53 to executive positions.
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Using a single platform such as Indeed was a deliberate methodological choice. Web scraping requires consistency in the structure and format of webpages, which Indeed provides through its standardized job listing architecture. This uniformity enabled efficient and scalable data collection, eliminating the need to customize scraping scripts for multiple sources with varying layouts and structures. Furthermore, the primary objective of this study is to analyze a large volume of job postings relevant to SCM rather than developing a generalized web scraping framework. Relying on a single, structured, and comprehensive source thus ensures data quality and methodological efficiency.

URLs corresponding to these 47 job titles were retrieved using the Python modules Requests¹, Selenium² and BeautifulSoup³. Any duplicate URLs were deleted based on Job ID, resulting in a preliminary collection of 6,616 job postings. After filtering out inaccessible URLs, the dataset comprised 6,125 unique job postings. For each job listing, the following information was downloaded: Job Title, Associated Keywords, Location, Salary, and Job Description.

Before analyzing the data, it was preprocessed to remove special characters, numbers, and punctuation using the Python library re⁴ (regular expression operations). Job descriptions missing from the dataset were identified and excluded, resulting in 4,595 job postings remaining in the dataset. All text was then normalized to lowercase to mitigate discrepancies caused by case differences. Python's Natural Language Toolkit (NLTK⁵) was used to refine the dataset further to remove 'stop words'—commonly used words like articles, pronouns, conjunctions, adverbs, and prepositions that bear minimal semantic weight in NLP contexts. This step reduces data volume to focus on meaningful linguistic elements.

The dataset underwent tokenization, segmenting the text into discrete units or 'tokens,' typically words or subwords. This process breaks down the text into analyzable components. Additionally, lemmatization was applied to convert words to their base or dictionary forms to ensure a clearer interpretation of job descriptions.

Analytical approach

¹ <https://pypi.org/project/requests/>

² <https://selenium-python.readthedocs.io/>

³ <https://pypi.org/project/beautifulsoup4/>

⁴ <https://docs.python.org/3/library/re.html>

⁵ <https://www.nltk.org/>

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3 The scale of the job advertisement dataset necessitated a scalable and automated text analysis. Latent
4 Dirichlet Allocation (LDA), a topic modelling technique, was chosen for its ability to handle large datasets
5 efficiently while extracting meaningful patterns. LDA has proven effective in generating a structured
6 understanding of job market demands (see, for instance, Herold and Roedenbeck, 2024; Ao *et al.*, 2023; Ge
7 *et al.*, 2022).

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12 The initial phase of the analysis focused on extracting and ranking job titles by frequency. This list provides
13 a preliminary view of prevailing trends in the SCM job market. The analysis then turned to the prominence
14 of soft skills and work readiness attributes. Finally, the demand for analytical competencies and references
15 to software packages and programming capabilities were assessed. In the second stage of the analysis, LDA
16 (using `gensim.models.LdaMulticore`⁶) was employed for topic modelling. As a generative probabilistic
17 model, LDA posits that each document in the dataset is a composition of topics, each a blend of words.
18 LDA then assigns probabilities to latent topics based on word occurrences. Applying LDA to the corpus of
19 job descriptions distills a high-level thematic structure that maps the SCM competency needs. This analysis
20 was conducted using the Python module `pyLDAvis`⁷.

21 22 23 24 25 26 27 28 **Results**

29 *Job titles frequency analysis*

30 The frequency analysis of job titles directly reflects current demand and priority areas in SCM. Figure 2
31 presents these findings by listing the most prevalent job titles. In analyzing SCM job titles, we categorized
32 roles into four main types based on their functional focus and frequency in the data: Specialized Roles,
33 which require specific expertise or operational focus; Managerial Roles, focused on overseeing operations
34 and teams in SCM functions; Executive Roles, which denote senior leadership positions responsible for
35 strategic direction; and Technical and Coordination Roles, which involve hands-on or support functions
36 essential to supply chain workflows.
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55 ⁶ <https://radimrehurek.com/gensim/models/ldamodel.html>

56 ⁷ <https://pypi.org/project/pyLDAvis/>

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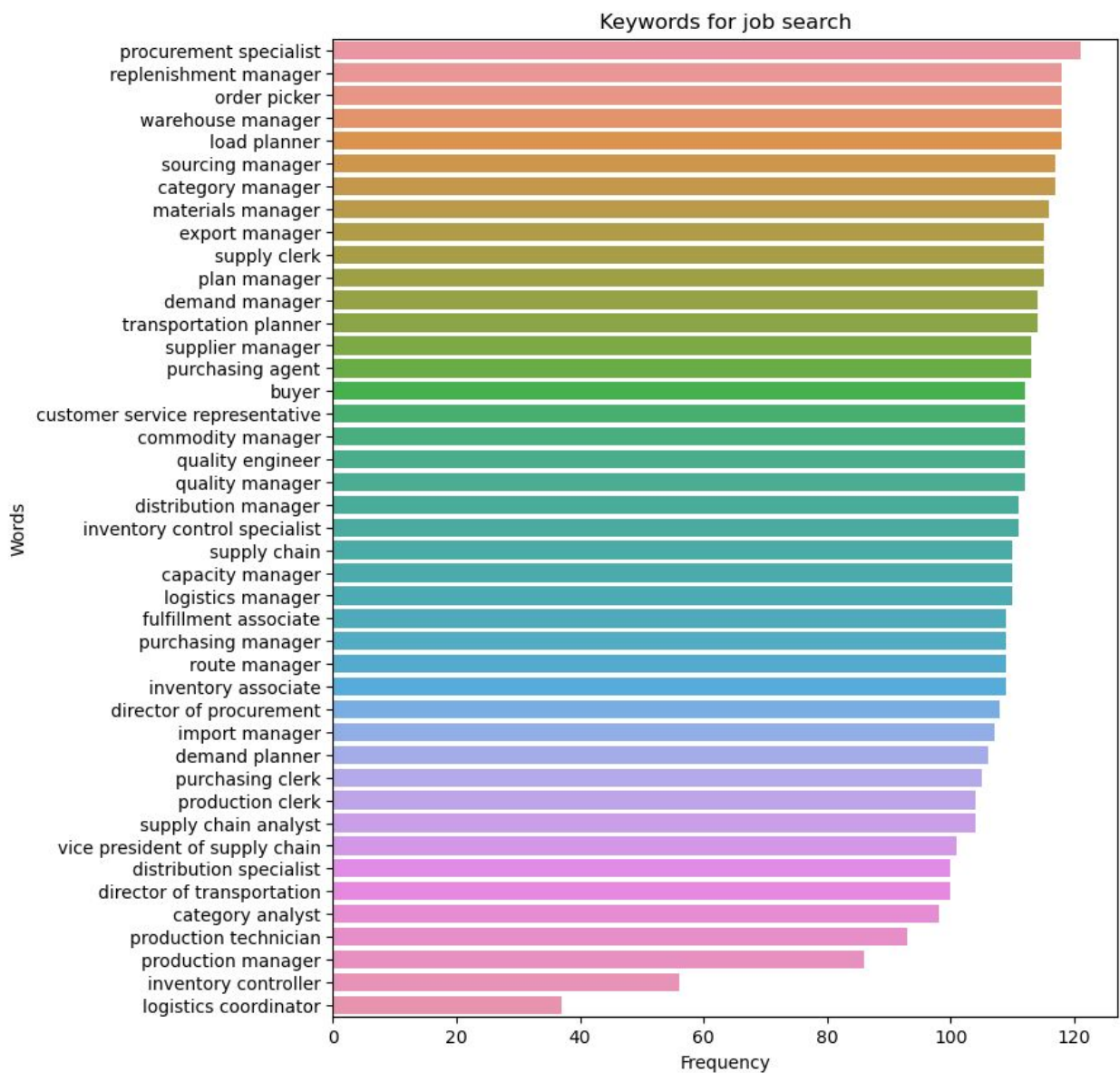


Figure 2. Ordered frequencies of job titles

The data reveals a high demand for specialized roles. Positions such as *Procurement Specialist*, *Replenishment Manager*, and *Order Picker* appear frequently, indicating a strong market demand for specific skills and responsibilities in SCM. Additionally, there is a demand for managerial roles, with titles like *Warehouse Manager*, *Load Planner*, *Sourcing Manager*, and *Category Manager* suggesting an evenly distributed need for managerial expertise across SCM. Strategic roles, including *Plan Manager* and *Demand Manager*, are well-represented, possibly pointing to an evolving focus on strategic planning and long-term management in SCM.

Roles related to distribution and quality control, such as Distribution Manager, Quality Engineer, and Quality Manager, are highly represented. These roles highlight the focus on distribution efficiency and product quality. In contrast, executive positions like Director of Procurement, VP of Supply Chain, and Director of Transportation appear less frequently, reflecting these roles' specialized and high-level nature. Meanwhile, technical or coordination-focused roles, including Production Technician and Logistics Coordinator, display a wider frequency range. This variability suggests a more localized demand for these positions, reflecting niche skills tailored to specific SCM functions or regional contexts.

Work readiness frequency analysis

The extent and nature of work readiness and soft skills—as categorized in the analysis—are shown in Figure 3.

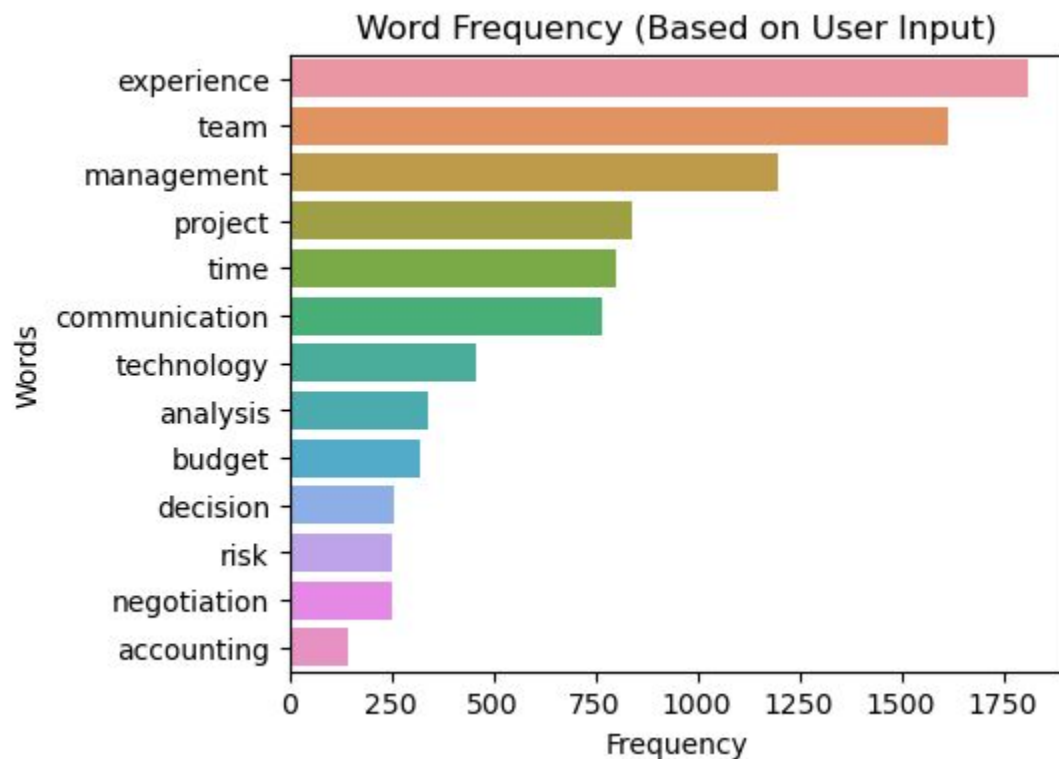


Figure 3. Ordered frequencies of transversal skills

Examining the frequencies of different soft skills reveals a layered hierarchy of in-demand competencies. *Experience*, *Teamwork*, and *Management* are the most frequently cited soft skills, indicating a preference for candidates who blend expertise with team collaboration and managerial prowess. This combination of skills underscores a holistic competence valued in leadership roles. As a second layer, the request for

Project and *Time Management* skills emphasizes the importance of efficiency and the ability to execute and deliver within tight timelines. Simultaneously, *Communication* holds a similar frequency, underscoring its transversal significance across various roles for effective team collaboration and information exchange.

The next tier of skills, including *Technology*, *Analysis*, and *Budget*, points to more specialized competencies essential in roles requiring data-informed decision-making and fiscal management. However, their necessity varies more significantly across different positions. In the strategic skillset category, *Decision*, *Risk*, *Negotiation*, and *Accounting*, while less frequent, are crucial for roles impacting organizations' strategic direction and financial stewardship. Their presence at similar frequency levels highlights their relevance in senior, strategy-oriented positions.

Analytical and applications frequency analysis

This analysis examines analytical skills, software packages, and programming abilities referenced in the job advertisements. Figure 4 presents the frequency of analytical skills alongside specific software and programming tools in job advertisements. This comparison demonstrates the growing demand for digital proficiency in data management and analysis in SCM roles.

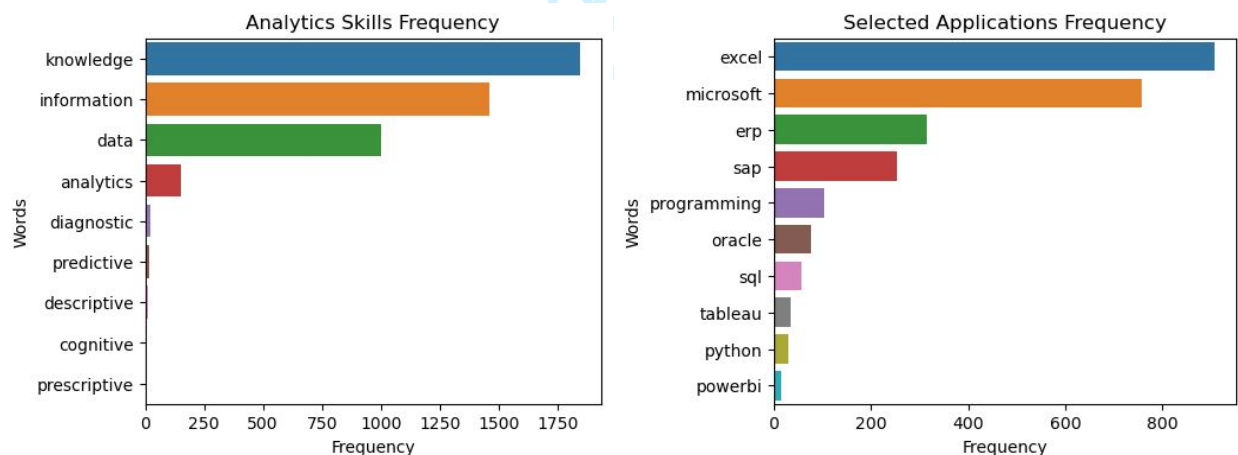


Figure 4. Ordered frequencies of analytical skills and applications

In this analysis, frequent terms like *Knowledge*, *Information*, and *Data* reflect a strong demand for foundational data competencies. These elements form the core of data-informed decision-making in SCM, while more advanced analytical abilities appear less frequently. Notably, terms like *Analytics* are considerably less prevalent, as are references to specific types—*Descriptive*, *Diagnostic*, *Predictive*, and *Prescriptive*—which are more dispersed and infrequent. These observations suggest that while the market

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3 values a foundational understanding of data and information in business decision-making, explicit
4 analytical skills are typically associated with more specialized roles.
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8 This trend in analytical skill demand is mirrored in the software and programming domain. The frequency
9 analysis reveals a clear hierarchy of preferred software packages and programming skills in the job market.
10 *Excel's* dominant position illustrates its fundamental role in data management and analysis, with *Microsoft*
11 *Office* also widely cited due to its general relevance in business operations. *ERP* systems, especially *SAP*,
12 signify the importance of integrated business processes and specialized software proficiency. In contrast,
13 more technical programming and advanced data analytics tools, including *Oracle*, *SQL*, *Tableau*, *Python*,
14 and *Power BI*, appear less frequently, suggesting a growing but still limited demand for these skills.
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20 Altogether, the frequency analysis points to a job market that values a combination of foundational
21 knowledge, traditional analytical skills, and emerging technical competencies. This analysis reflects current
22 demand as expressed in job advertisements rather than an exhaustive inventory of SCM capabilities. The
23 limited mention of certain terms, such as AI, indicates present hiring priorities and may shift over time as
24 industry needs evolve.
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30 *LDA analysis for topic modelling*

31 Topic modelling distilled ten topics, each characterized by ten terms. Of these, seven topics were deemed
32 to contain meaningful and interpretable content: Topics 1, 3, 5, 6, 7, 9, and 10. Detailed outputs for these
33 topics are provided in Appendix A.
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38 Topic 1 encompasses a dual focus (Output A.1 in Appendix A). It reflects the operational aspects of SCM
39 roles—evident in terms like “supply chain,” “work location,” “communication skills,” and “customer
40 service”—and employee resources and well-being, as seen in terms such as “dental care,” “enhanced
41 health,” and “salary pay.” This combination suggests that job advertisements integrate functional
42 expectations with attention to workplace benefits, with a joint focus on operational competence and a
43 supportive work environment. An interpretative label for Topic 1 is *Operational Excellence and Employee*
44 *Welfare*. The combination of terms aligns with the job demands-resources (JD-R) model, illustrating the
45 balance between job demands (e.g., operational tasks) and job resources (e.g., benefits and supportive
46 conditions) (Bakker and Demerouti, 2017). It reflects the importance of sustaining both employee
47 satisfaction and performance.
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3 Topic 3 (Output A.2 in Appendix A) centers on strategic development and planning in supply chain
4 management. The prominence of terms such as “planning,” “policy,” and “professional development”
5 indicates a focus on strategic foresight, governance, and adherence to standards. An interpretative label for
6 this topic is *Strategic Development and Policy Planning*.
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11 Topic 5 (Output A.3 in Appendix A) highlights practical work conditions and language proficiency in SCM.
12 Frequent references to work arrangements and to “English” indicate the relevance of employment terms
13 and communication skills. An interpretative label for this topic is *Work Conditions and Language*
14 *Proficiency*.
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19 Topic 6 (Output A.4 in Appendix A) reflects leadership roles in technical sectors. References to high-level
20 positions, sector-specific expertise, and “corporate standards” suggest demand for technically proficient
21 and regulation-aware leaders. An interpretative label for this topic is *Leadership in Technical Environments*.
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25 Topic 7 (Output A.5 in Appendix A) focuses on logistics and transportation. Terms such as “Air Cargo,”
26 “Uline Uline,” and “Supply Chain,” along with references to “maintenance engineering,” “clinical trial,”
27 “national level,” and energy-related sectors, point to the strategic role of logistics in high-stake industries
28 such as energy and pharmaceuticals. An interpretative label for this topic is *Strategic Logistics and Supply*
29 *Chain Dynamics in High-Stakes Industries*.
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35 Topic 9 (Output A.6 in Appendix A) addresses the regulatory dimension of SCM. Terms such as “Public
36 Service” and time-related references highlight a focus on compliance and time-tracking, both central to
37 regulatory processes. An interpretative label for this topic is *Regulatory Compliance and Time Tracking*.
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41 Finally, Topic 10 (Output A.7 in Appendix A) focuses on project coordination in large-scale institutional
42 contexts. References to “Infrastructure Ontario” and “Fraser Health” point to public sector roles involving
43 complex projects, with an emphasis on scheduling and facilities oversight. An interpretative label for this
44 topic is *Project Management and Institutional Coordination*.
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49 *Integrated findings*

50 The combined insights from the frequency analysis and topic modelling reveal a multifaceted but integrated
51 SCM competency framework with foundational, operational-strategic, and specialized technical skills.
52 Figure 5 visually represents these core competencies and their intersections in a Venn diagram format.
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Foundational skills—experience, teamwork, communication, and management—are highly valued, reflecting a preference for professionals with collaborative and leadership capabilities. Operational and strategic competencies, including project and time management, strategic development, and data utilization, signal a growing emphasis on data-informed decision-making and operational efficiency. Specialized and technical skills—such as expertise in technical environments, logistics, supply chain dynamics, and advanced analytics—highlight the demand for domain-specific knowledge that supports innovation and process optimization.

Figure 5 illustrates the SCM industry’s holistic approach, which values both individual competencies and their integration. This framework offers a basis for understanding current demands and anticipating future developments in SCM.

INTEGRATED FINDINGS: FREQUENCY ANALYSIS & TOPIC MODELLING

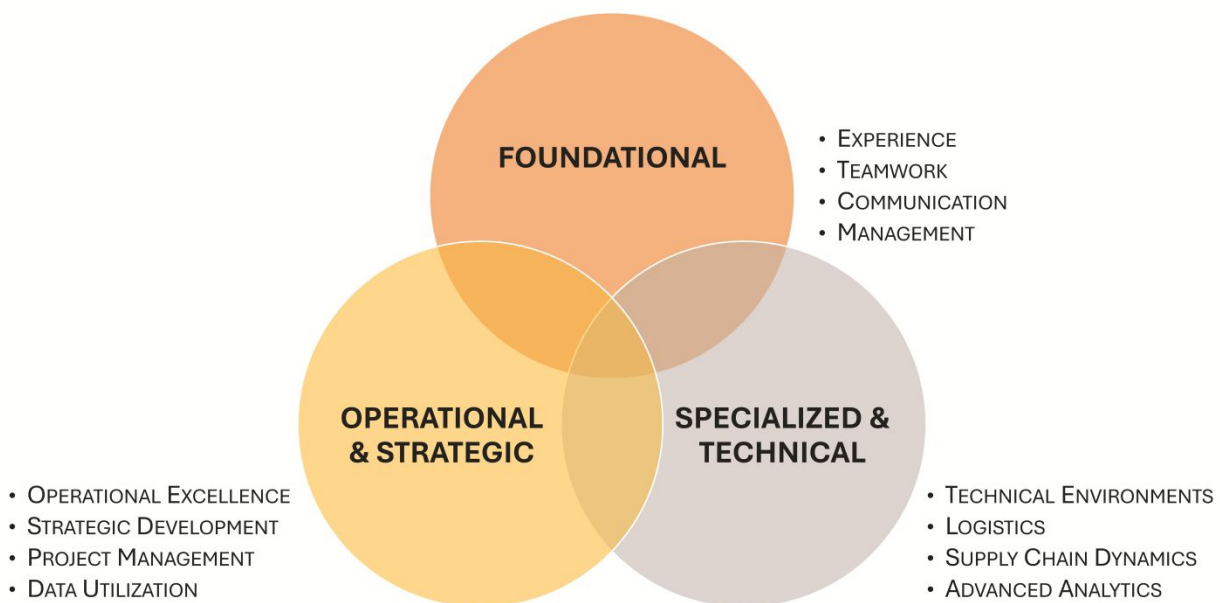


Figure 5. Integrated findings of frequency analysis and topic modelling

Discussion

This study examined the competency demands associated with SCM’s ongoing evolution as an adaptive and interdisciplinary field (Carter *et al.*, 2015; Hoberg *et al.*, 2020). SCM has emerged as a multifaceted yet integrated discipline that combines operational and strategic elements, aligning with earlier analyses that demonstrate its boundary-spanning scope and blurred lines with traditional business functions (Mentzer *et al.*, 2008; Swanson *et al.*, 2018). This evolution creates a need for a comprehensive skill set that balances

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3 technical proficiency with adaptability and cross-functional competencies. These insights were developed
4 through a combined approach: tracing SCM's functional origins and disciplinary trajectory while analyzing
5 competency patterns in a large dataset of job advertisements.
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9 The literature review traced SCM's evolution from a logistics-focused, unifunctional field to an integrated
10 discipline with relational and strategic dimensions (Giunipero *et al.*, 2008; Bak *et al.*, 2019). This transition
11 reflects a growing expectation for professionals to combine specialized technical expertise with transversal
12 competencies to support systemic thinking and adaptability in increasingly complex environments
13 (Enstroem and Schmaltz, 2024; Gámez-Pérez *et al.*, 2020).
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17 As SCM has evolved from a logistics-focused discipline to a more integrated and strategic field, it has also
18 assumed a boundary-spanning role. This development aligns with prior research on SCM's adaptive and
19 multifunctional nature, which notes the integration of traditional business functions across organizational
20 boundaries (Carter *et al.*, 2015; Hoberg *et al.*, 2020). Boundary-spanning in SCM reflects the need to bridge
21 internal silos and external interfaces by coordinating cross-functional activities and engaging stakeholders
22 such as suppliers, customers, and regulatory bodies (Norlyk Jørgensen *et al.*, 2023). This integrative
23 function positions SCM as a critical enabler of organizational responsiveness and alignment in dynamic
24 and interdependent environments.
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33 Theoretical perspectives on boundary-spanning identify it as a mechanism for facilitating communication,
34 reducing redundancies, and enhancing responsiveness across interdependent functions and external
35 partnerships (Norlyk Jørgensen *et al.*, 2023). These capabilities are particularly relevant in SCM, where
36 professionals are expected to act as integrative agents who align goals and processes across organizational
37 boundaries. This expectation reflects SCM's evolution into a strategic interface between internal efficiency
38 and external complexity (Mentzer *et al.*, 2008; Enstroem and Schmaltz, 2023). In a VUCA environment,
39 such boundary-spanning capabilities are essential for protecting organizational agility and adaptability.
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46 Text mining of job advertisements revealed a three-dimensional competency structure comprising
47 foundational, operational-strategic, and specialized-technical skills. Foundational competencies—
48 experience, teamwork, and general management—stand out, consistent with earlier studies highlighting the
49 importance of soft skills in SCM roles (Bak *et al.*, 2019; Fantozzi *et al.*, 2024). Operational and strategic
50 competencies, including project and time management as well as strategic planning, are increasingly
51 supported by data literacy. This reflects the field's shift toward data-informed decision-making and
52 operational efficiency (Dubey *et al.*, 2021; Govindan *et al.*, 2022). Notably, the topic modelling also
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underscores SCM's growing reliance on analytics and digital tools, confirming the link between technological integration and strategic adaptability (Frederico *et al.*, 2020; Narwane *et al.*, 2021).

The findings align with the Harmonized Information-Technology and Organizational Performance (HI-TOP) model, which foregrounds the integration of technological proficiency and collaborative capabilities as critical for improved productivity (Enstroem *et al.*, 2024). According to the model, productivity emerges from a cohesive system where job performance, teamwork, and knowledge exchange operate in synergy with digital infrastructure and information flow to support informed decision-making. This framework is particularly relevant to SCM's continued evolution by stressing the need for professionals who can manage data-informed operations while maintaining adaptability in a VUCA environment.

The need for specialized and technical skills reflects SCM's increasing reliance on digital tools, advanced analytics, and data-centric processes. This trend signals an industry-wide shift toward integrating technical expertise to support innovation, automation, and operational optimization (Dubey *et al.*, 2021; Modgil *et al.*, 2023). It aligns with recent studies on digital transformation in SCM, which note the growing value of professionals who can operate fluently across both digital infrastructures and physical supply chains (Frederico *et al.*, 2020; Narwane *et al.*, 2021).

While digital tools and analytics were prominently featured, it is notable that AI as a standalone term was not frequently mentioned in the job ads. This absence may reflect the way AI is operationalized in practice—through embedded applications in analytics, automation, or optimization—rather than being explicitly named. It may also illustrate a lag between the strategic discourse surrounding AI and its concrete articulation in role-specific competency requirements in SCM hiring.

Our findings underscore the importance of education, training, and professional development programs that embed technical, relational, and strategic skills as integrated learning outcomes. This aligns with prior calls to rethink SCM talent development in response to Industry 4.0 and supply chain digitalization (Whysall *et al.*, 2019; Lutz *et al.*, 2022). Industry-academic collaborations—including work-integrated learning, ongoing professional development, and applied training—are increasingly necessary to align graduate attributes with evolving industry needs (Gámez-Pérez *et al.*, 2020; Enstroem, 2018). Future research could use complementary methods such as focus groups, structured interviews, or job analysis to triangulate competency findings. In parallel, efforts should be made to develop articulated SCM competency frameworks and benchmark scales that support curriculum design, talent assessment, intervention evaluation, and the upgrading of training and professional development programs. Nevertheless, job

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3 advertisements offer a timely, market-sensitive lens and a pragmatic means of capturing employers' actual
4 expectations in real-world SCM contexts (Barbosa and Oliveira, 2021; Kim and Angnakoon, 2016).
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8 **Implications for practice**

9 *Profession and Industry:* The findings point to the importance of a holistic approach to SCM competencies,
10 where technical and soft skills are integrated to ensure individual and organizational adaptability and
11 innovation. Organizations that invest in hiring and developing these competencies can strengthen supply
12 chain resilience and agility. This study highlights key competencies valued in the industry, which can guide
13 professionals in developing their skills to align with market needs. Additionally, the identification of high-
14 demand competencies offers industry leaders insights to refine recruitment, talent development, and
15 retention strategies in line with competitive demands.
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22 *Academia and Professional Bodies:* There is an opportunity for educational institutions and certification
23 bodies to update programs to reflect industry trends and competency demands. For example, specialized
24 roles like Procurement Specialist and Replenishment Manager could benefit from tailored curriculum
25 content. The demand across managerial functions signals the importance of embedding managerial skills
26 in SCM curricula to improve students' readiness for diverse SCM roles. Frequently cited terms such as
27 "Knowledge," "Information," and "Data" indicate that employers highly value data management and
28 analysis skills. The demand for advanced analytical skills, including specific tools like Oracle, SQL, and
29 Python, suggests a need for curricula that equip students with both foundational and specialized analytical
30 capabilities.
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38 *Hiring Agencies/HR:* Hiring agencies play a critical role in aligning high-demand SCM competencies with
39 candidate profiles. A skill-based selection approach enables more effective talent acquisition. Agencies can
40 improve the accuracy of job descriptions by incorporating sought-after skills and software proficiencies to
41 attract qualified candidates. Additionally, agencies can help bridge gaps in job ads by advising clients on
42 in-demand skills not listed to improve candidate-role alignment and attract a broader talent pool.
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48 **Conclusion**

49 This study establishes a foundation for advancing research and practice in SCM. Our analysis highlights a
50 shift towards a holistic and integrated competency profile that combines technical expertise with soft skills.
51 To our knowledge, this is the first study applying a computer-assisted grounded theory framework with
52 unsupervised ML algorithms to analyze large-scale SCM job data.
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3 Future research could further delineate the skills, experience, and educational requirements associated with
4 SCM roles—from entry-level to leadership positions—to support clearer career pathways. As this study
5 draws solely on data from Indeed.com, future research should integrate data from additional platforms and
6 align findings with formal competency frameworks, such as those developed by Supply Chain Canada, to
7 provide a more comprehensive view of industry expectations.
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12 While the importance of both technical and interpersonal competencies in SCM is widely acknowledged,
13 this study substantiates those priorities through a rigorous, data-informed analysis of market demand. By
14 leveraging machine learning to analyze job advertisements, the study contributes a scalable empirical lens
15 on SCM role expectations. It offers a foundation for the development of articulated, industry-aligned
16 competency frameworks that can inform curriculum design, professional development, and workforce
17 planning in a dynamic and digitally transforming field.
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SCM COMPETENCE MILIEU

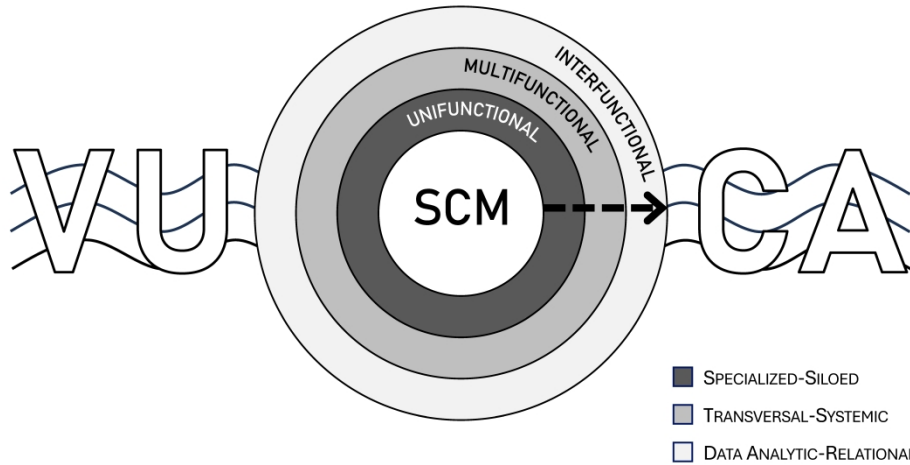


Figure 1. The changing competence requirements of supply chain professionals

338x190mm (600 x 600 DPI)

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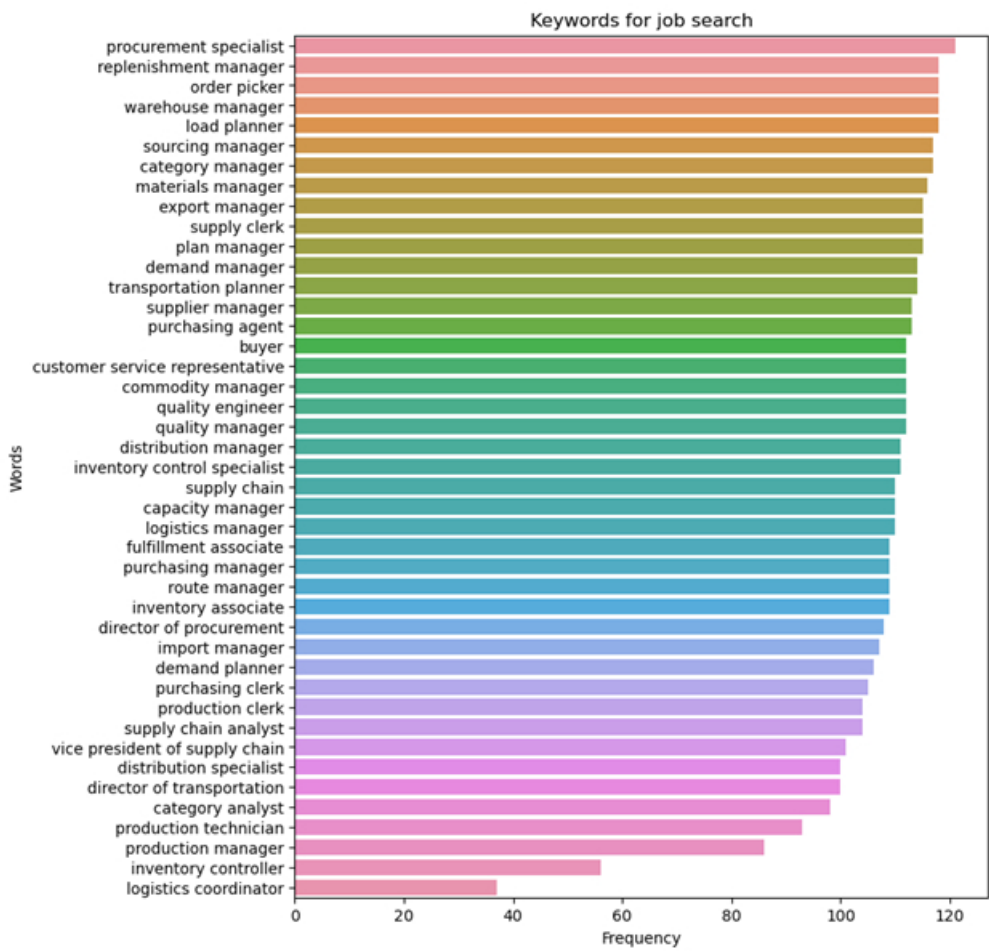


Figure 2. Ordered frequencies of job titles

417x398mm (38 x 38 DPI)

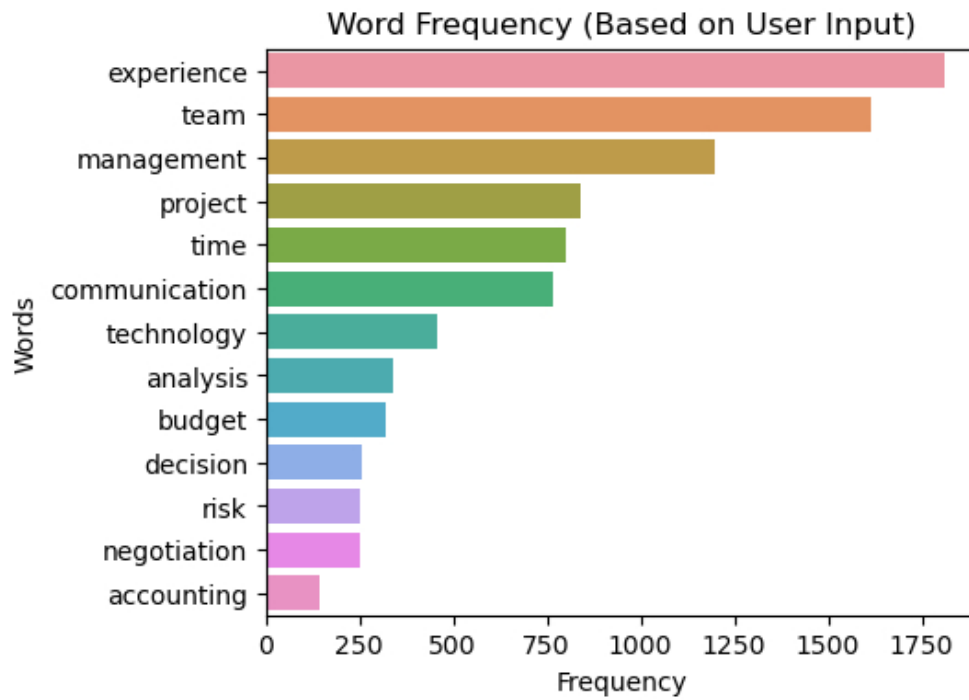


Figure 3. Ordered frequencies of transversal skills

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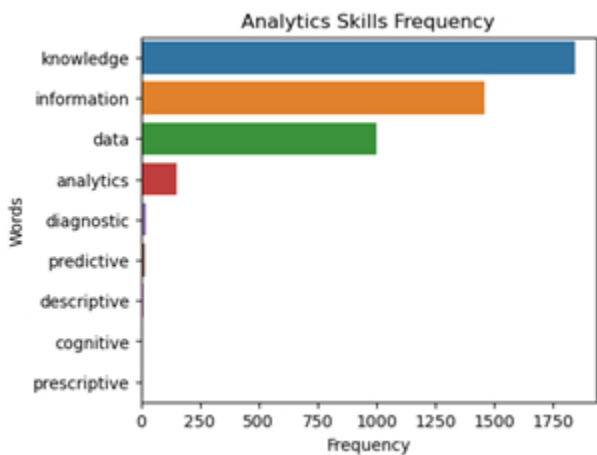


Figure 4. Ordered frequencies of analytical skills and applications
203x154mm (38 x 38 DPI)

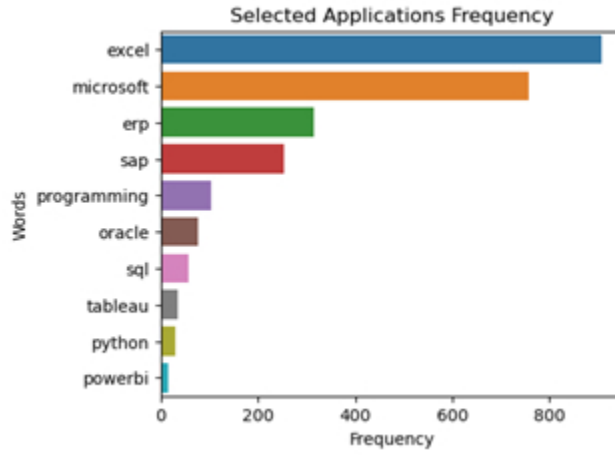


Figure 4. Ordered frequencies of analytical skills and applications

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INTEGRATED FINDINGS: FREQUENCY ANALYSIS & TOPIC MODELLING

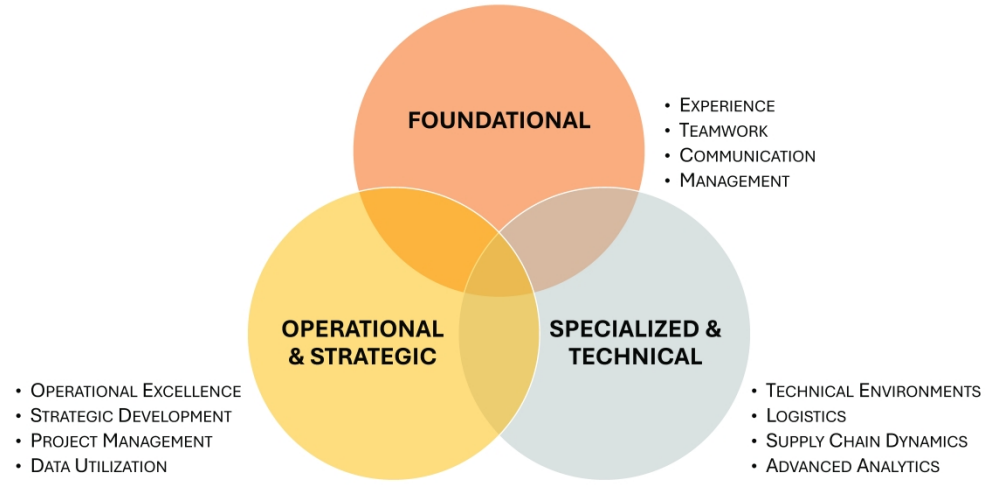
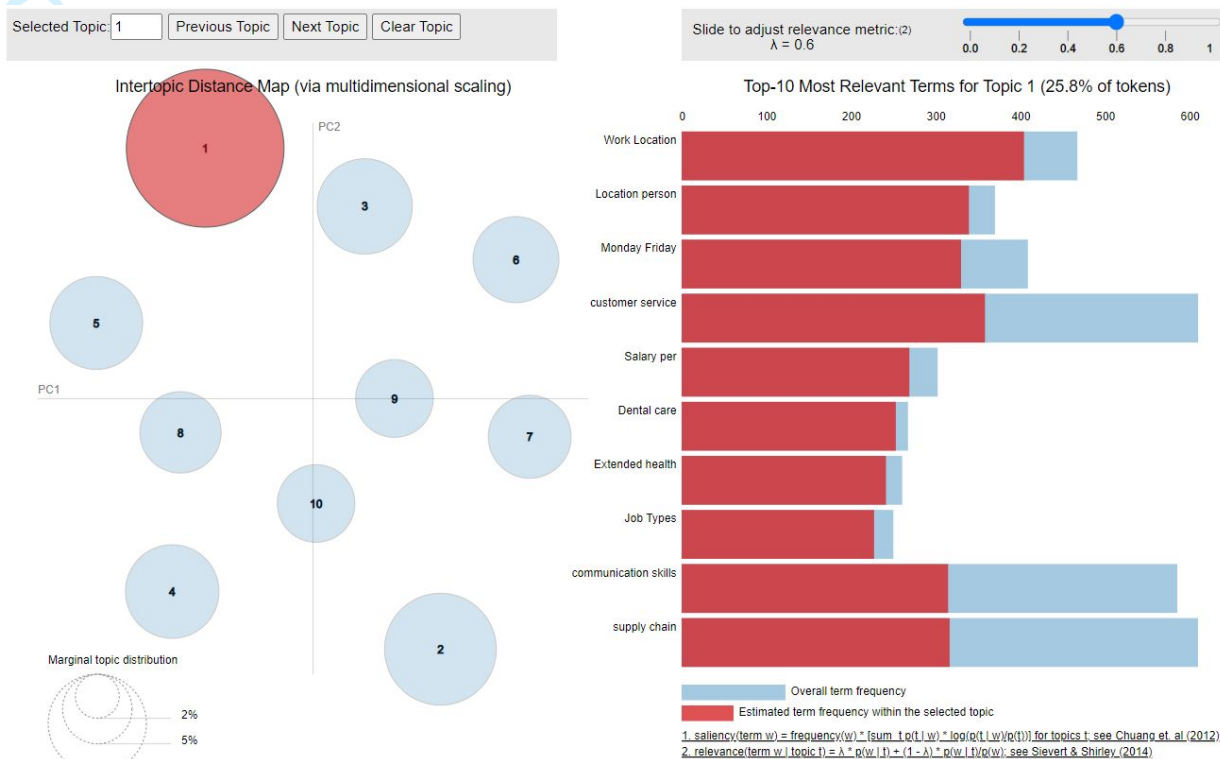


Figure 5. Integrated findings of frequency analysis and topic modelling

338x190mm (600 x 600 DPI)

Appendix A

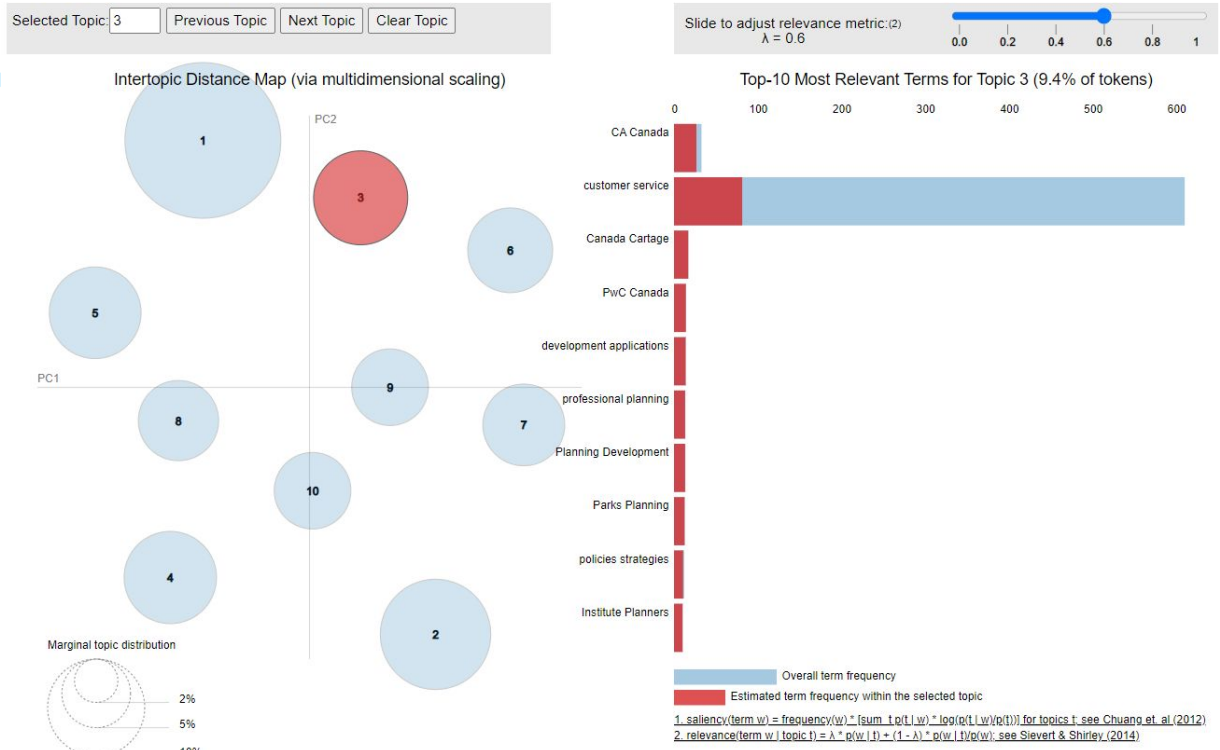


Output A.1: Topic 1

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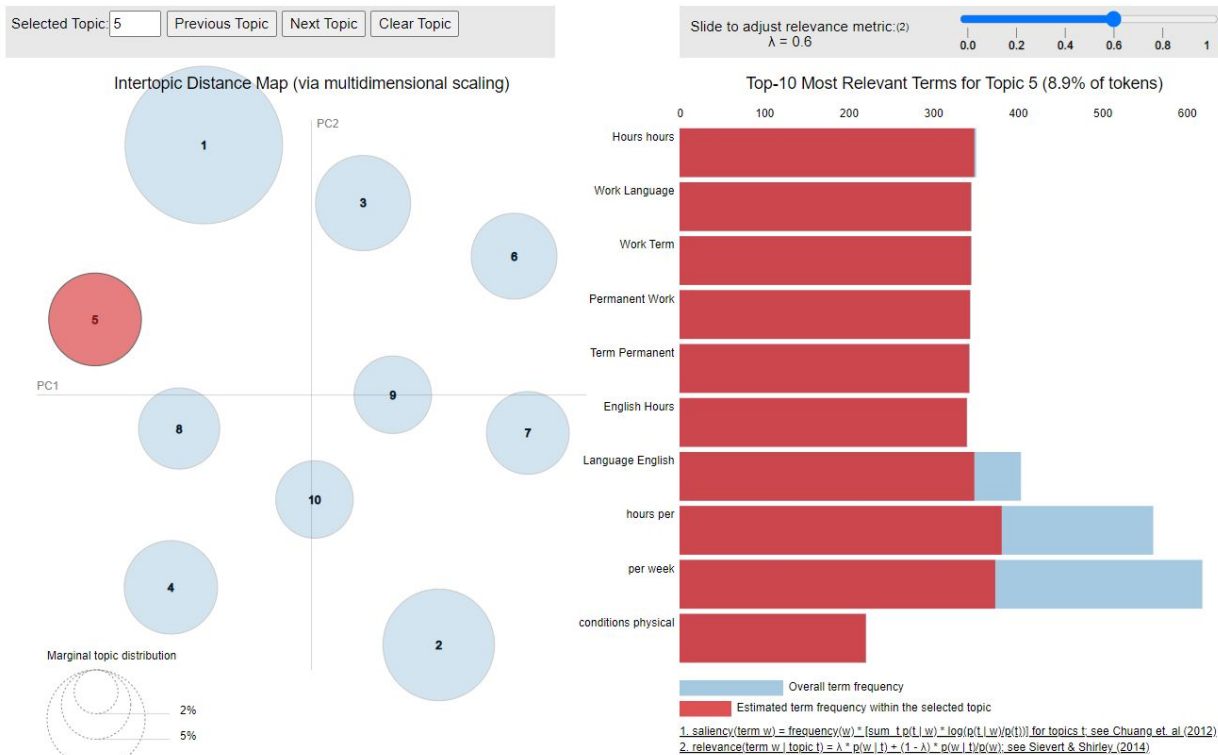
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Output A.2: Topic 3

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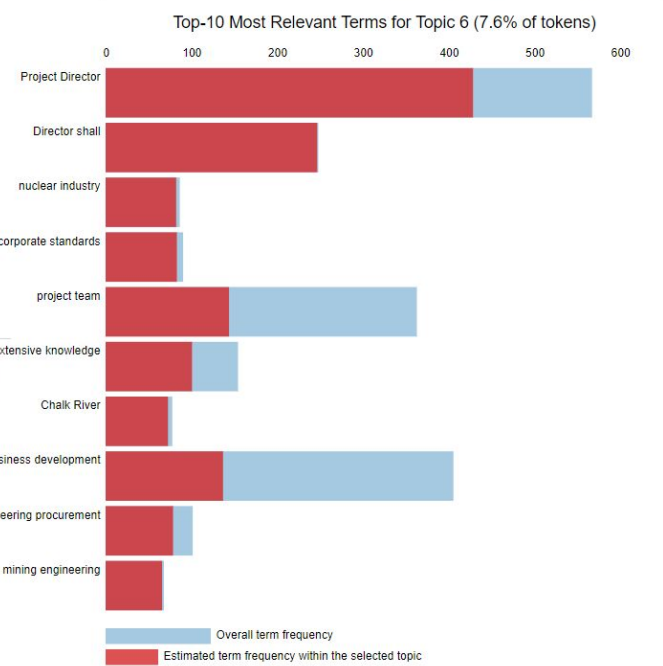
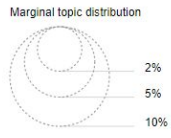
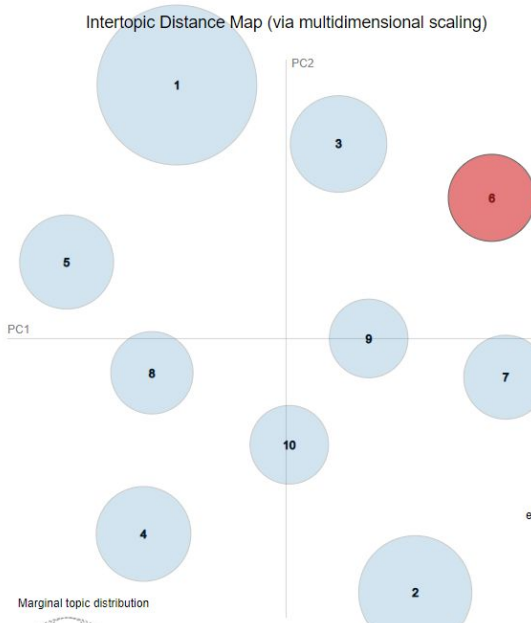
Output A.3: Topic 5

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Selected Topic: Previous Topic Next Topic Clear Topic

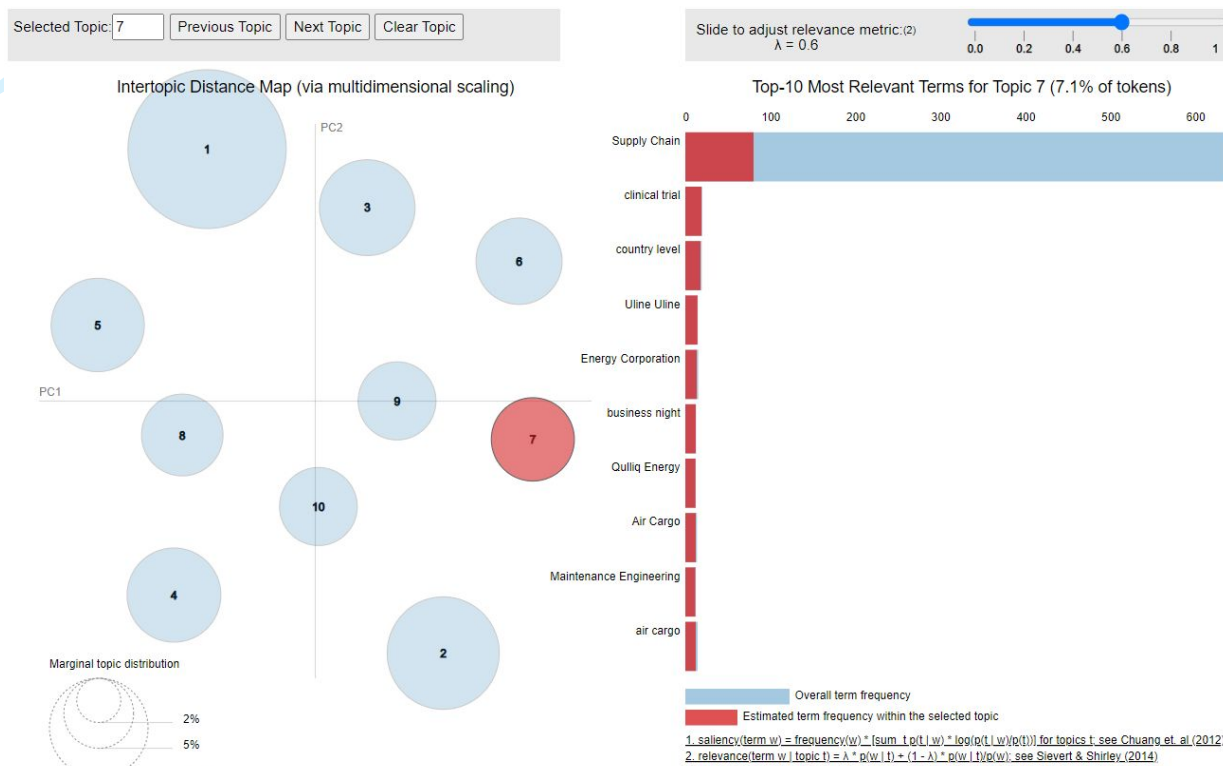
Slide to adjust relevance metric:(2)
λ = 0.6



1. $saliency(term\ w) = frequency(w) * (\sum_t p(t|w) * \log(p(t|w)/p(t)))$ for topics t , see Chuang et al. (2012)
 2. $relevance(term\ w | topic\ t) = \lambda * p(w | t) + (1 - \lambda) * p(w | t)/p(w)$, see Sievert & Shirley (2014)

Output A.4: Topic 6

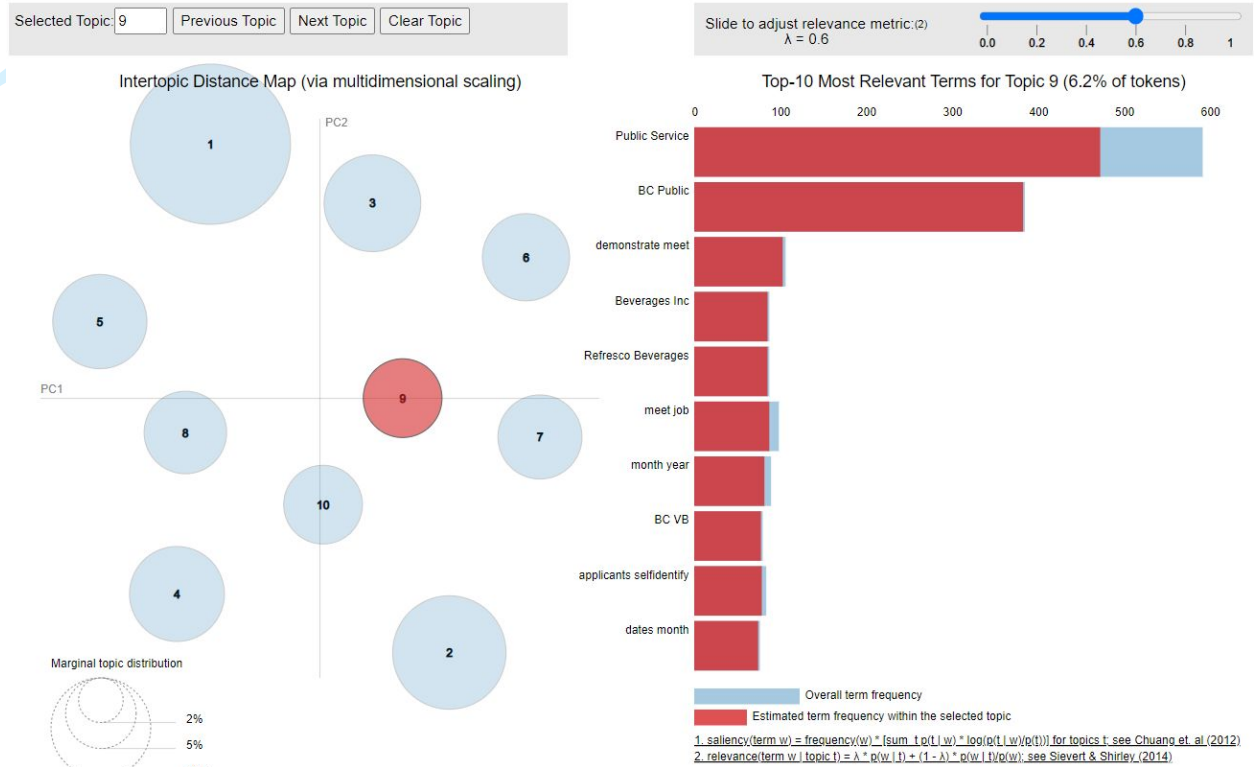
Journal of Management Development



Output A.5: Topic 7

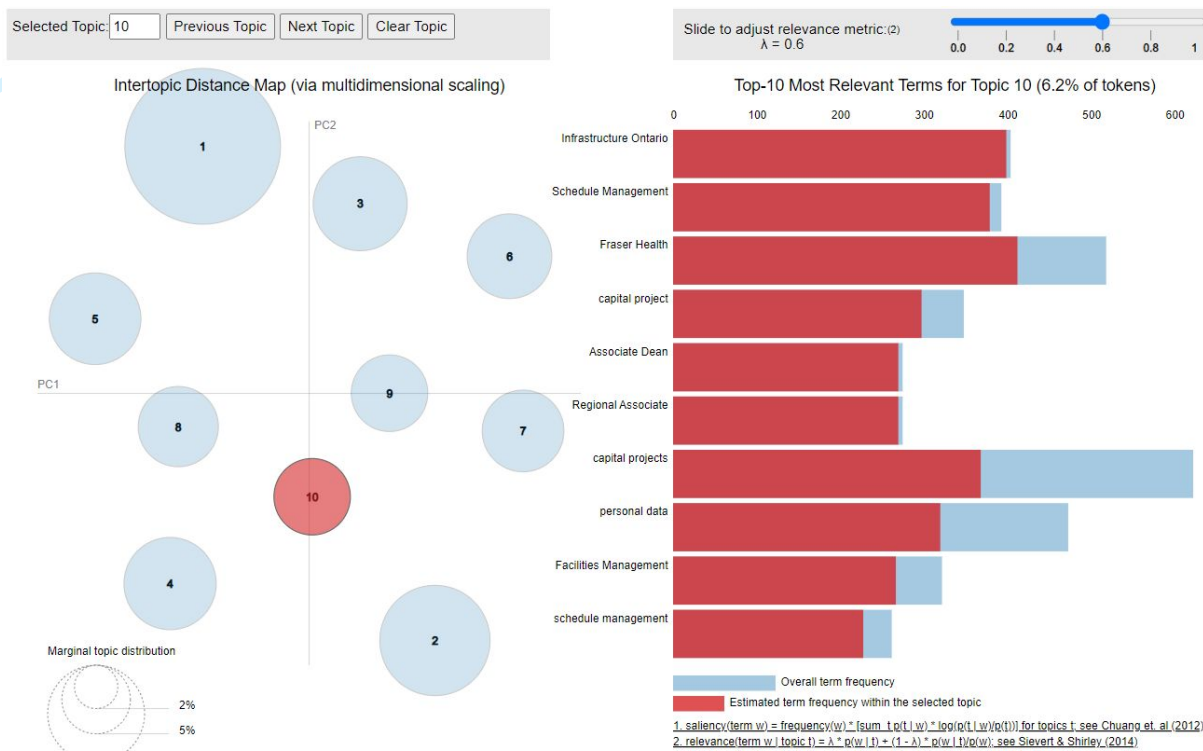
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Output A.6: Topic 9

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Output A.7: Topic 10

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