Leveraging Scientific Research for Business Improvement: A PRISMA Review

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Abstract: University-Industry Collaboration (UIC) is a crucial driver of knowledge exchange, traditionally framed by the triple, quadruple, and quintuple helix models. While these models emphasize synergistic collaboration and mutual benefits stemming from strong relationships, a key aspect often overlooked is industry's capacity to utilize existing scientific knowledge, such as research articles. Universities consistently generate new scientific insights, offering a vast, underutilized resource for knowledge transfer beyond conventional UIC frameworks, particularly for Small and Medium-sized Enterprises (SMEs). This paper addresses this gap through a comprehensive systematic literature review. Following PRISMA methodology, we identified a foundational set of 616 articles from diverse scientific databases using a three-tiered core concept approach: 1) SMEs, 2) scientific research results, and 3) business improvement. A semantic search program, leveraging a pre-trained sentence-embedding model, then pinpointed relevant case studies. After rigorous threshold fine-tuning, 18 articles were selected for in-depth qualitative analysis. Preliminary automated analysis revealed thematic categories for Access challenges, Impact assessment, Research focus, and Utilization strategies. The in-depth analysis further explores the interplay within these themes, focusing on identifying research gaps within the literature. The insights derived will contribute to furthering the understanding of knowledge transfer dynamics in UIC and SME innovation, highlighting practical avenues for facilitating SME engagement with scientific knowledge.

Keywords: Literature Review, University-Industry Collaboration, SMEs, Research Utilization

1. Introduction

Universities and other Higher Education Institutions (HEIs) are key in preparing business professionals and entrepreneurs with up-to-date knowledge. Heavily funded by governments, HEIs drive research that supports local and national innovation and business growth. When public funding declines, universities must seek alternative sources and engage more directly in business value creation. University-Industry Collaboration (UIC) is a widely used open innovation model that facilitates this knowledge and technology transfer between academia and industry (El-Ferik and Al-Naser 2021). The Triple Helix model captures the interconnected roles of universities, governments, and industries (Etzkowitz and Leydesdorff 2000), with later versions further refining these relationships (Cai and Etzkowitz 2020).

To meet these challenges, universities increasingly commercialize academic knowledge through collaborations with businesses and government, such as licensing, incubators, and start-up programs (O'Shea, Chugh and Allen 2008; Phan, Siegel and Wright 2005). Success in commercialization requires close, long-term commitment from both academic and external partners (Cirella and Murphy 2022). The impact of innovation efforts varies depending on UIC involvement. For instance, "made in academia" innovations attract less attention than those from industry (Bikard 2018), and discoveries with industry ties yield more scientific publications but fewer follow-on patents than those without (Bikard, Vakili, and Teodiridis 2019).

Dynamic capabilities theory explains how firms adapt and succeed in changing environments by integrating, building, and reconfiguring competencies (Teece, Pisano and Shuen 1997). This approach emphasizes strategic renewal over static resources. Firms with strong dynamic capabilities can generate new ideas, develop products and services, and renew business models, especially when they collaborate closely with institutions (Gölgeci et al 2019; Bloedon & Stokes, 1994).

Research shows that UIC is vital for knowledge transfer, innovation, and improved performance. The Triple Helix model (Etzkowitz & Leydesdorff 2000) and dynamic capabilities theory (Teece, Pisano and Shuen 1997) help explain how firms—especially resource-constrained SMEs—can use external knowledge for competitive advantage. However, how knowledge transfer from academia to SMEs works in practice is still not fully understood.

Most research focuses on formal UIC channels, like joint research, incubators, and licensing (Tereschenko et al 2024), but often ignores informal knowledge acquisition. Formal collaborations can be costly and time-consuming, making them difficult for many SMEs. Micro SMEs, in particular, need clear, practical justifications for knowledge transfer (Väisänen 2024).

This research posits that SMEs can enhance their dynamic capabilities and drive innovation by utilizing academic research without engaging in these formal, structured collaborations. This more independent form of knowledge transfer, where SMEs access and apply publicly available scientific research (e.g., from research papers, reports, and open-access databases) to their operations, represents a distinct and under-researched phenomenon. The SMEs' own absorptive capacity drives it and is not contingent on direct, formal, and often long-term partnerships with universities. Thus, this study aims to systematically review the available literature to investigate how SMEs are utilizing publicly available scientific research results in their operations, contributing to the literature by providing a structured overview of a previously underexplored phenomenon.

2. Methodology

To ensure a transparent and replicable review of the literature, this study uses the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Moher et al 2009). The PRISMA statement provides a robust evidence-based foundation for reporting systematic reviews. The four phases—Identification, Screening, Eligibility, and Inclusion—guide the researcher through literature collection, selection, and final inclusion in the qualitative synthesis.

2.1 Document Identification

Since the Screening process relies on automated document retrieval, the Identification phase was set to include a document repository as large as possible. The researcher utilized the LUT Universities' library database, which gives access to the most common scientific databases:

- Scopus
- SAGE Premier
- ProQuest Databases
- Emerald Journals
- Elsevier
- EBSCO Academic Search Elite
- EBSCO Business Source Elite

The document identification phase involved identifying the following three core concepts from the documents: SMEs, Academic research, and Business Improvement. The following search terms were used for each concept to expand the three core concepts to provide a wide range of results (Table 1).

Table 1: The three core concepts used in the Identification stage.

Core Concept 1 (SME)	Core Concept 2 (Academic Research)	Core Concept 3 (Business Improvement)
SME	academic research	business improvement
small and medium-sized enterprise	university research	competitiveness
small and medium-sized business	knowledge transfer	efficiency
small business	research finding	performance
		value creation
		competitive advantage

All the databases included have differing search functionalities, but all of them allow the user to utilize Boolean logic in their searches. By utilizing the core concepts presented in Table 1, the Boolean pseudo-query for all the databases was as follows:

(sme OR "small business" OR "small and medium-sized enterprise" OR "small and medium-sized business") AND ("academic research" OR "university research" OR "knowledge transfer" OR "research finding") AND ("value creation" OR profitability OR competitiveness OR efficiency OR "competitive advantage" OR "business improvement" OR "performance")

Additionally, the eligibility criteria for inclusion were to have the articles peer-reviewed and openly accessed. As previously mentioned, each platform had its own search functionalities and result classifications. Table 2 presents the classifications for the results along with the number of results identified.

Table 2: The number of results from the Identification phase per database.

Database	Result Classifications	Results
Scopus	Journal + Article + English + Final + Open Access	121
SAGE Premier	Research + Open Access	102
ProQuest Databases	Scholarly journals + Full text + Peer reviewed	150
Emerald Journals	Articles + open access	212
Elsevier	Research + Open Access + English	18
EBSCO Academic Search Elite	Full text + peer reviewed + academic journal	4
EBSCO Business Source Elite	Full text + peer reviewed + academic journal	9

The initial Identification phase of this study yielded a substantial corpus of 616 journal article abstracts sourced from the databases. The subsequent screening phase presented a significant methodological challenge. This phase typically requires the researcher to manually review the title and abstract of every identified record to exclude clearly irrelevant ones. Given the volume of abstracts and the complex nature of the inclusion criteria, a purely manual screening process was deemed susceptible to researcher fatigue, subjectivity, and potential inconsistency over time (Beller et al., 2018). Furthermore, the core inclusion criteria for this review were conceptual rather than keyword-based, requiring the identification of articles that were 1) a case study, and 2) concerned an SME that has utilized university research results. Therefore, a simple keyword search would likely be insufficient to capture the semantic essence of these concepts. Specific challenges would be expected in, e.g., recognizing synonyms (e.g., "small firm" for "SME"), related concepts (e.g., "knowledge transfer" or "technology adoption" for "utilized university research"), and the specific context of their use. Thus, an automated screening tool was proposed to tackle this issue (O'Mara-Eves et al., 2015).

2.2 Screening

A semi-automated screening methodology was developed to address these challenges while upholding the systematic principles of PRISMA. This Python-coded approach leverages modern Natural Language Processing (NLP) techniques to perform a semantic-based pre-screening of the abstracts.

The core of the semi-automated methodology was implementing a semantic search protocol. Unlike traditional search methods that match literal text strings, semantic search aims to understand language's intent and contextual meaning, while sustaining adequate computational viability (Pratt-Hartman 2013, pp. 90). This is achieved by converting text into high-dimensional numerical representations, known as "embeddings," where the semantic relationships between texts are reflected in the geometric properties of their vector representations. This approach allowed for the screening of abstracts based on their conceptual similarity to a precisely defined query that encapsulated the full inclusion criteria.

2.3 Data Preparation and Parsing

The initial step involved parsing the source material of the 616 journal abstracts, which underwent the semantic search protocol on a database-by-database basis. A custom Python script was developed to iterate through each list of abstracts, correctly identifying and separating each record. The format of the abstract extraction files differed slightly from database to database, so a slight modification of the Python code was necessary for each database. The semantic engine and inclusion criteria remained unchanged for each database, however. For every record, the script extracted the essential metadata—the paper's title and its corresponding URL—and the full text of the abstract. The abstracts were cleaned of any file-specific prefixes (e.g., "ABSTRACT:") to create a refined corpus consisting solely of the abstract texts, ready for analysis. This automated data extraction ensured consistency and eliminated the potential for manual copy-paste errors.

2.3.1 Model Selection and Semantic Query Definition

The cornerstone of the semantic analysis was a pre-trained sentence embedding model. This study used a Bidirectional Encoder Representations from Transformers (BERT) model, called all-MiniLM-L6-v2, suitable for various NLP tasks (Santander-Cruz et al 2022). This framework fine-tunes such models for generating semantically meaningful sentence embeddings, making them highly suitable for semantic search and similarity

comparison tasks. The choice of model represented a pragmatic balance between high performance and computational efficiency, capable of processing the corpus on standard hardware (SBERT.net 2025).

A precise "semantic query" was then formulated to represent the ideal abstract that this review sought to find: "A case study about a small or medium-sized enterprise (SME) utilizing university research results in its operations." This query serves as the conceptual benchmark against which all abstracts are measured.

2.3.2 Embedding Generation and Similarity Calculation

The semantic query and all 616 abstracts were transformed using the selected model into 384-dimensional vector embeddings. Each vector represents a point in a high-dimensional space, and the semantic content of the source text determines its location. Cosine similarity was employed as the measurement metric to quantify the semantic relationship between the query and each abstract. Cosine similarity calculates the cosine of the angle between two vectors, producing a score between -1 (perfectly opposite meaning) and 1 (identical meaning). A score of 0 indicates orthogonality or a lack of semantic relationship. This metric is particularly well-suited for high-dimensional data as it is sensitive to the vectors' orientation (i.e., the direction or "meaning") rather than their magnitude. The result of this step was a comprehensive list of all abstracts, each paired with a cosine similarity score indicating its relevance to the research query.

2.3.3 Ranking, Filtering, and Final Screening

The abstracts were ranked in descending order based on their cosine similarity scores. This provided a data-driven prioritization of the corpus, with the most conceptually relevant articles at the top. A similarity threshold 0.5 was established to create a binary distinction between "potentially relevant" and "excluded" abstracts. This threshold was determined through an iterative review of the top-ranked results, ensuring that it was sensitive enough to include relevant studies while remaining specific enough to exclude irrelevant ones. Lower thresholds were manually tested.

All abstracts scoring above this threshold were advanced to the next stage of the PRISMA workflow for full-text review. This procedure presented 29 articles. Two of the articles were duplicates, and none of them were illegible or written in any other language besides English, so these two duplicates were the first to be eliminated in the Eligibility stage. The second and final Eligibility stage included manual reading of the articles. While the content of all the articles did revolve around the research topic, the criteria for inclusion were that the research paper would have to be a case study, where an SME (or a group of SMEs) utilized academic research results. Nine articles were dropped from the analysis for not meeting these criteria, meaning the final number of articles in the Inclusion stage was 18.

3. The Results

The extracted documents were analyzed both manually and using the Atlas.ti software. In this context, we are looking for information on how SMEs utilize academic research results, such as research papers and reports, to improve their competitiveness. Atlas.ti software utilizes Intentional AI coding functionality from the OpenAI software company, using its GPT models, allowing the researcher to input their research questions, context, and overall intention of the research. The models then translate this intention into concrete questions and provide the researcher with categorization in the form of separate code categories.

To ensure transparency and replicability, the first step was to document the intention with which the AI codes are created. As the main intention for the model, we input the general research question: “How are SMEs utilizing Academic research results to improve their competitiveness?”. This prompt generated four distinct research questions from the articles, each associated with a specific code category for thematic analysis:

- RQ1: How are SMEs utilizing Academic research results to improve their competitiveness? (Code category: Utilization Strategies)
- RQ2: What specific academic research results are most frequently utilized by SMEs? (Code category: Research focus)
- RQ3: How do SMEs measure the impact of academic research on their competitiveness? (Code category: Impact assessment)
- RQ4: What challenges do SMEs face in accessing and applying academic research? (Code category: Access challenges)

The stability and reliability of the AI-generated framework were verified through multiple runs of the same prompt. This process confirmed the consistency of the generated research questions and code categories, mitigating the risk of model inconsistencies or hallucinations and ensuring a robust foundation for the subsequent analysis.

The articles' content was analyzed in two ways to ensure consistency and transparency. First, the articles were analyzed by automatically finding specific concepts using the Atlas.ti software. This results in a word cloud-like concept cloud. Since the concept cloud utilizes word frequencies along with semantic analysis, some manual deletion of concepts such as “et al”, “authors”, and “pages” was performed. Second, these concepts were cross-checked by the author by manually reading all the articles to gain a deeper understanding of the nuances of the phenomenon. We start the process by examining the concept cloud in Figure 1.

Figure 1: The concept cloud from the 18 articles from the Inclusion stage.

By looking at the most prominent concepts mined from the articles, we can see that “innovation” is the most occurring one, gathering 1756 mentions, or tokens, across the analyzed articles. To simplify the process and to avoid redundancy, we take all concepts with over 1000 tokens into closer examination. Table 3 shows the concepts and attached sub-concepts (general or vague sub-concepts such as “innovations” or “business case” were omitted).

Table 3: The four main concepts and their sub-concepts from the articles.

Concept	Sub-concept
Innovation	Open innovation
	Product innovation
	Business model innovation
Sme	Family sme
	Technology-based sme
	Business models
	Business model innovation
	Family business
Knowledge	Knowledge management
	Knowledge transfer
	Knowledge collaboration

Concept	Sub-concept
	New knowledge
	Knowledge spillover
	Tacit knowledge
Performance	Operational performance
	Innovation performance
	Growth performance
	Financial performance
	Performance measurement

Building upon the code categories established through Intentional AI, the analysis of key concepts using the Atlas.ti "Concepts" tool provides a thematic overview of the literature and offers preliminary insights into the research questions. The concepts—Innovation, SME, Knowledge, and Performance—and their sub-concepts form interconnected thematic clusters that illuminate the dynamics of academic knowledge utilization by SMEs. The following sections are structured around the four primary research questions, demonstrating how the conceptual analysis sheds light on each.

- RQ1. Utilization Strategies

The prominence of knowledge management, knowledge transfer, and knowledge collaboration as sub-concepts within the Knowledge cluster indicates that knowledge utilization is not a passive reception of information. Instead, it is an active endeavor that requires a high degree of organizational engagement. The literature suggests that successful strategies often involve close collaboration and trust with "knowledge brokers" like universities (Audretsch et al 2023; Franco et al 2024).

The articles further specify a number of these strategies, including participation in local science park incubators and communal activities (Bortoluzzi et al 2022; Nowacki and Stanieski 2012; Marom and Lussier 2017), as well as engagement in broader governmental programs (Bouwman et al 2018; Yadewani et al 2024). The findings also reveal a defined division of labor, where academic institutions tend to assume a knowledge facilitator role, while SMEs are positioned as the primary innovators (Lundberg and Öberg 2021). The emphasis on open innovation policies in the literature also points to a key strategy, as collaboration with universities is seen to accelerate SMEs' open innovation capabilities (Audretsch et al 2023).

- RQ2. Research Focus

The sub-concepts within the Innovation and Knowledge clusters point to a strong focus on research that can drive strategic transformation. The high occurrence of open innovation as a sub-concept, especially in the context of I4.0 industries (Parra-Sanchez and Talero 2023; Bortoluzzi et al 2022), suggests that academic work on this topic is highly relevant. Similarly, the focus on business model innovation indicates that SMEs are leveraging academic research not just for incremental operational changes, but as a catalyst for fundamental shifts in their business models and product development as part of the larger open innovation paradigm (Sabando-Vera et al 2022). While these singular findings may point toward a strategic long-term commitment, the few longitudinal studies found did not conclusively confirm this notion.

- RQ3. Impact Assessment

The Performance thematic cluster directly addresses how the impact of utilizing academic research is assessed. The variety of sub-concepts including operational performance, innovation performance, growth performance, and financial performance. The articles show that impact is assessed both in pure financial terms (Yadevani et al 2024; Amoros, Planellas and Batista-Foguet 2007) and more holistically (Manville et al 2018), as well as by metrics such as readiness for change (Chao ang Kang 2022). This suggests that both SMEs and researchers are interested in capturing the full spectrum of benefits, from enhancing efficiency to fostering a more innovative internal culture.

- RQ4. Access Challenges

The analysis of the Knowledge cluster, specifically the sub-concepts of knowledge spillover and tacit knowledge, reinforces the notion that knowledge transfer is not always straightforward. Nowacki et al (2012) further specify financial barriers as a significant obstacle to knowledge transfer. This is particularly relevant when considering

governmental or educational programs aimed at knowledge facilitation, as the emergence of tacit knowledge emphasizes their importance in improving SME performance (O'Connor & Kelly 2017).

The SME cluster also contributes to understanding challenges and the factors that help overcome them. The literature suggests that the specific type of SME (e.g., family SME vs. technology-based SME) may influence their challenges and strategies. An entrepreneurial mindset, for example, was identified as a positive indicator for SME performance (Issau, Soni and Acquah 2022; Marinelli et al 2023; Marom and Lussier 2017), suggesting that firm-level attitudes are key to overcoming access barriers. Additionally, power relationships between actors can also be an obstacle (O'Connor & Kelly 2017), indicating that smaller firms might be at a disadvantage.

4. Reflection

Literature on University-Industry collaboration in and of itself is abundant (see e.g. Tereshenko et al 2024). This literature review was conducted to gain insight into a small subsection of UIC: SMEs utilizing scientific research results to improve their business operations. The criteria for inclusion were that the research paper would have to be a case study, where an SME (or a group of SMEs) was utilizing academic research results. Of all the identified 616 articles, only 18 were included in the final examination. This relatively low number of articles was somewhat surprising, but also points out a research gap, which could warrant closer examination in the future. Future studies should empirically examine the organizational processes and contextual factors that enable SMEs to absorb and apply scientific knowledge, perhaps through in-depth case studies. Longitudinal or comparative studies were also missing in the review. Comparative research on formal versus informal knowledge transfer mechanisms, as well as investigations into sectoral, regional, or firm-size differences, would further enrich our understanding. Methodological limitations of this review must also be acknowledged. The reliance on automated semantic screening, while efficient, may have excluded relevant studies due to model limitations or threshold settings. The small sample size, though partly reflecting a true research gap, also might challenge the generalizability of our findings. The error in this study was mitigated by carefully choosing the language model used for the screening, as it was specifically chosen for its semantic capabilities. Another mitigating factor was that the same model was used separately on all seven databases, and manual inspection of the results lists showed clear thematic consistency across all runs. Future reviews could benefit from combining automated and manual screening approaches, using multiple NLP models, and seeking out unpublished or gray literature.

Besides the topic's novelty, one possible explanation to low article count is that all cases where SMEs utilize scientific results likely never see the light of day. If a research result is publicly available, and an SME decides to utilize it, they most likely don't have the incentive to publish it, as supported by Bikard (2018). In this case, the utilization potential is largely dependent on the SMEs internal absorptive capacity.

This literature review contributes to the academic discourse by establishing a foundational understanding of this under-researched area. The scarcity of literature on SMEs' independent utilization of academic research not only validates the existence of a significant research gap but also highlights the need for a more expansive view of knowledge transfer. This study offers a structured overview of a phenomenon that has previously been overlooked in favor of more formal, institutionalized collaborations, providing a clear direction for future scholarly work. This review demonstrates that SMEs' ability to benefit from academic research hinges on their absorptive capacity—especially in the knowledge transfer domain. Our findings show that knowledge transfer is most effective when SMEs actively engage in knowledge management and collaboration, even outside formal partnerships. Furthermore, the results highlight that dynamic capabilities are essential for SMEs to transform scientific insights into innovation and to assess their impact. Thus, the independent use of academic research by SMEs is not just about access, but about building the organizational capacity to turn knowledge into competitive advantage, while the Universities take on the facilitator role. From a practical perspective, the findings hold substantial value for SMEs and policymakers. The identified patterns of utilizing incubators and business parks should incentivize regional and governmental actors to support these initiatives. Additionally, universities are encouraged to embrace facilitating knowledge transfer in conjunction with these parks, where they can reside close to the local SME community.

Ethics Statement

Ethical clearance was not required in this research.

AI Declaration

Generative Artificial Intelligence tools were used in the generation of this paper the following way: 1) Proofreading and grammatical errors (Grammarly), 2) Refining the overall tone of the text and checking for inconsistencies (Gemini 2.5).

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