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Ethics, Transparency, and Consumer Trust in AI-Enabled Pricing: Implications for Sustainable Technology Entrepreneurship and Economic Policy[☆]



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ABSTRACT

AI-driven dynamic pricing has evolved from an optimisation technique into a core infrastructure of the digital economy, such as the European Union Artificial Intelligence Act and global guidelines for trustworthy AI move towards implementation, questions of fairness, transparency, and consumer trust in algorithmic pricing have become urgent for firms, regulators, and entrepreneurial ventures alike. Start-ups and scale-ups are often at the frontier of deploying these systems as sustainable technology for resource-efficient demand management and revenue resilience, yet their dependence on legitimacy makes them particularly exposed to ethical, reputational, and market-acceptance failures. Despite the rapid growth of research on AI ethics, the specific intersection between algorithmic design, normative imperatives, and consumer-centric outcomes remains conceptually fragmented and insufficiently mapped.

This study provides a bibliometric mapping of the emerging ethical agenda in AI-driven dynamic pricing at the interface of entrepreneurship, economics, and sustainable technology. A dataset of 38 peer-reviewed articles (2019–2025) was retrieved from Scopus using a targeted search combining dynamic pricing, Artificial Intelligence, and ethics/transparency/consumer trust. Using VOSviewer and Biblioshiny, the analysis integrates performance indicators, keyword co-occurrence, co-citation structure, and thematic evolution. The findings reveal a clear post-2022 shift from optimisation-centric work towards a more integrated discourse in which fairness, transparency, and trust become structurally central. Two dominant clusters emerge, pricing mechanisms with distributive implications and AI-enabled methodologies, while recent literature increasingly links technical design to consumer protection and economic governance, echoing policy developments associated with the European Union *Artificial Intelligence Act* and debates on circular economy-compatible market practices.

Introduction

Over the past two decades, the fusion of Artificial Intelligence (AI) techniques with dynamic pricing strategies has redefined the economic logic of price setting (Araf et al., 2025) across industries. From airline yield management to algorithmic retail repricing and real-time ride-hailing fare adjustments, machine learning, deep learning, and reinforcement learning models have enabled unprecedented levels of

temporal granularity and demand responsiveness (Zong et al., 2025). Yet, this technological sophistication has also introduced a series of ethical, regulatory, and behavioural challenges (Chen et al., 2024). High-profile cases, ranging from surge pricing during emergencies to algorithmically-driven personalised discounts (Spann et al., 2024), have drawn public scrutiny to issues of algorithmic opacity, distributive justice, and consumer autonomy.

In parallel, policy frameworks, such as the European Union's

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The participants in this study are expressly aware of the purpose of the work and have given their consent. They came forward on a voluntary basis.

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Artificial Intelligence Act (Laux et al., 2024) and the OECD's guidelines on trustworthy AI (Lund et al., 2025) are beginning to exert structural influence on the design, deployment, and disclosure requirements of algorithmic pricing systems. These shifts mark a decisive transition: dynamic pricing research can no longer be understood solely as a branch of computational optimisation (Momin & Mishra, 2024); it must also be situated within the broader discourse on fairness, transparency, and accountability in automated decision-making (Senyapar et al., 2025).

However, despite an expanding volume of publications on AI-driven pricing, the scholarly landscape remains fragmented. Operations research and computer science have prioritised model accuracy, computational efficiency, and revenue maximisation, often without engaging with the normative or experiential dimensions of pricing. Conversely, marketing and consumer behaviour literature has examined perceptions of price fairness and trust (Grashuis, 2025), yet with limited technical engagement in the AI mechanisms that underpin these practices. This bifurcation has left the intersection of algorithmic design, ethical considerations, and consumer outcomes comparatively underexplored.

Entrepreneurship adds a further dimension to this fragmentation. Start-ups and new ventures (Abbas & Al-Lawati, 2025; Pollák et al., 2025) are frequently the first adopters of AI-enabled dynamic pricing, using it as a competitive lever in highly volatile markets. For these entrepreneurial firms, dynamic pricing serves not only as a technological innovation (Sharma, 2025) but also as a survival strategy. Yet this adoption brings heightened exposure to ethical scrutiny: because new ventures rely heavily on legitimacy, breaches of fairness or transparency in pricing can jeopardise consumer trust and investor confidence (Ramachandran, 2025). At the same time, entrepreneurship also enables agility in implementing explainable AI frameworks and models that consider fairness, positioning start-ups as potential leaders in setting benchmarks for responsible pricing practices (Solaz et al., 2025).

The present bibliometric study addresses this lacuna by systematically mapping the emergence and evolution of the ethical agenda within AI-driven dynamic pricing research between 2019 and 2025. It focuses specifically on three interlocking thematic axes: (i) algorithmic architectures and optimisation frameworks; (ii) ethical imperatives, including fairness, transparency, and explicability; and (iii) consumer-centric outcomes, such as trust, perceived equity, and behavioural adaptation. Although the resulting corpus—comprising 38 peer-reviewed journal articles—may appear modest in size, it is in fact indicative of an emergent and highly specialised research niche whose intellectual contours are only beginning to crystallise.

Accordingly, the study is guided by the following research questions:

RQ1. How have fairness, transparency, and trust-related concepts emerged and evolved within AI-driven dynamic pricing literature over the past quarter-century?

RQ2. To what extent do scholarly contributions explicitly link algorithmic pricing mechanisms to consumer protection concerns?

RQ3. Which research communities and geographical clusters are most actively integrating ethical considerations into dynamic pricing discourse?

By integrating performance analysis, conceptual structure mapping, and thematic evolution analysis, this work offers not only a panoramic view of the current knowledge base but also a forward-looking framework for research and policy. In doing so, it positions ethical AI in dynamic pricing as both a pressing scholarly domain and a field of immediate regulatory significance.

The remainder of this article is structured as follows. Section 2 develops the theoretical background on AI-driven dynamic pricing, ethical concerns, transparency, regulatory change, and entrepreneurship. Section 3 outlines the bibliometric research design, including data collection, cleaning procedures, and analytical techniques. Section 4 presents

the empirical findings through performance indicators and the conceptual, intellectual, and thematic structures of the field. Section 5 discusses the theoretical, practical, and policy implications of these results. Section 6 concludes by summarising the main contributions, acknowledging limitations, and outlining avenues for future research.

Theoretical background

Dynamic pricing and AI in contemporary markets

Dynamic pricing refers to the strategic adjustment of prices in real time or near-real time in response to variations in demand, supply, competitive actions, and contextual factors (Aladaileh & Lahuerta-Otero, 2025). Traditionally, the practice emerged in industries such as airline yield management (Mullapudi, 2025) and hospitality (da Silva, 2024), where demand forecasting and inventory constraints necessitated granular price adjustments.

The introduction of AI expanded both the scope and complexity of dynamic pricing (Chenavaz & Dimitrov, 2025). AI enables the integration of high-frequency data streams, contextual variables (Abbas & Eldred, 2025) (e.g., location, device type, purchase history), and adaptive learning capabilities (Joshi, 2024). Machine learning and deep learning models, particularly gradient boosting methods and recurrent neural networks, capture non-linear demand relationships with greater accuracy (Douaioui et al., 2024).

Reinforcement learning approaches extend these capabilities by facilitating sequential decision-making under uncertainty (Bastani et al., 2025). These developments not only improve predictive performance but also enable hyper-personalisation of prices. The shift from market segmentation to individual-level pricing brings clear commercial opportunities (Turki, 2025) yet also introduces significant ethical considerations (Lemmens et al., 2025).

Price fairness and algorithmic ethics

Price fairness is a well-established construct in behavioural economics and marketing science, encompassing distributive fairness (perceived equity of outcomes) and procedural fairness (perceived equity of the decision-making process) (Yang et al., 2024). In AI-driven pricing, fairness extends beyond these dimensions to include the mitigation of algorithmic bias (Gazi et al., 2024), systematic disparities in pricing outcomes arising from skewed datasets or model architectures. Such biases can inadvertently perpetuate or amplify socio-economic inequalities (Araf et al., 2025). Discriminatory pricing patterns, even when unintended, may contravene consumer protection regulations. As a result, algorithmic ethics in pricing involves more than simple regulatory compliance (Spann et al., 2024): it demands the intentional design of systems that embed values such as non-discrimination, proportionality, and explainability (Akhtar et al., 2024).

This orientation has been reinforced by global ethical AI frameworks. For instance, UNESCO's *Recommendation on the Ethics of Artificial Intelligence* (Pasopati et al., 2024) explicitly calls for transparency in automated decision-making processes that directly affect individuals' economic interests.

Transparency, interpretability, and consumer trust

Transparency in AI-driven pricing operates on three interconnected levels. The first is model-level transparency (Chinnaraju, 2025), the ability to inspect, understand, and audit the logic of the algorithm itself. The second is decision-level transparency (Rajendra & Thuraisingam, 2025), the disclosure of the specific factors influencing an individual pricing decision. The third is system-level transparency (Senyapar et al., 2025), broader organisational openness about AI adoption, governance, and oversight.

Interpretability techniques, such as global feature importance

metrics or local explanation models (e.g., LIME, SHAP), are used to bridge the gap between complex algorithms and human understanding (Mathew et al., 2025). However, interpretability alone does not guarantee trust. Trust is an emergent property shaped by technical design, consumer perceptions, and institutional credibility.

Evidence indicates that consumers are more likely to accept dynamic pricing when they perceive procedural fairness and benevolent intent (Zhang & Cheng, 2024). Even when the immediate price outcome is unfavourable, transparency and perceived fairness can mitigate negative behavioural responses (Kim et al., 2024).

Regulatory and policy frameworks shaping the field

The regulatory landscape for AI-driven pricing is evolving rapidly (Spulbar, 2025). In the European Union (EU), the *Artificial Intelligence Act* classifies certain AI applications, potentially including personalised pricing based on sensitive attributes, as "high risk". (Sousa e Silva, 2025). This classification triggers stringent requirements for transparency, human oversight, and risk management.

In the United States, regulatory approaches are more fragmented. Agencies such as the Federal Trade Commission (FTC) have issued sector-specific guidelines focusing on algorithmic accountability and the prevention of consumer deception (Mishra & Varshney, 2024).

Internationally, the OECD *Principles on Artificial Intelligence* and the G20 AI guidelines emphasise fairness, transparency, and accountability in automated economic decision-making (Cavalcante, 2024). Although the scope and enforceability of these frameworks vary, they collectively signal a move towards normative governance of algorithmic pricing.

For scholars, these developments highlight the need to integrate regulatory and policy considerations into theoretical models. Bridging the gap between technical optimisation and normative evaluation is becoming an essential dimension of research in this field.

Entrepreneurship and new ventures

Entrepreneurship constitutes a critical dimension in the diffusion of AI-driven dynamic pricing. New ventures and start-ups, operating under conditions of resource scarcity and market uncertainty, frequently adopt algorithmic pricing models to optimise revenue and gain competitive advantage. For these firms, dynamic pricing not only represents a technological tool but also a strategic lever for survival and growth.

Entrepreneurial firms tend to operate in highly volatile environments, such as e-commerce platforms, mobility services, and digital marketplaces (Hu & Su, 2024), where experimentation with AI-enabled pricing can generate rapid insights into consumer behaviour. This experimentation, however, is often accompanied by heightened ethical exposure (Lacárcel, 2025). Unlike established corporations with entrenched reputational capital, entrepreneurial ventures rely heavily on consumer trust and investor confidence; breaches of perceived fairness or transparency in pricing can therefore have disproportionate consequences.

At the same time, entrepreneurship provides fertile ground for advancing best practices in algorithmic governance (hassania Rahou et al., 2025). Start-ups are typically more agile in integrating explainable AI frameworks, fairness-aware algorithms (Abbas & Al-Lawati, 2025), and transparent communication strategies. In doing so, they not only differentiate themselves competitively but also contribute to setting industry benchmarks for responsible innovation.

Thus, entrepreneurship acts as both a driver of innovation in dynamic pricing and a crucible for addressing its ethical challenges, positioning new ventures at the frontier where technological optimisation, consumer trust, and societal expectations intersect.

Methodology

Research design and scope

This study adopts a bibliometric approach to examine the intellectual and thematic evolution of the ethical agenda in AI-driven dynamic pricing research. Bibliometric analysis is particularly suited to fields where scientific output is either fragmented across disciplines or emerging in scope (Marzi et al., 2025). In such contexts, the objective is not solely to measure publication volume but to identify the conceptual structures, thematic linkages, and geographical patterns that define the research domain.

The resulting corpus comprises 38 peer-reviewed journal articles published between 2019 and 2025. While numerically modest, this dataset reflects the specialised nature of the intersection under investigation—dynamic pricing, Artificial Intelligence, and ethical/consumer dimensions. This thematic convergence is recent, with most contributions emerging in the last decade, coinciding with advancements in algorithmic personalisation and heightened regulatory discourse. Consequently, the size of the corpus is not a methodological constraint but an accurate representation of an emergent scholarly niche whose boundaries are still crystallising.

Data source and search strategy

The Scopus database was selected as the primary data source due to its comprehensive coverage of business, management, social sciences, and computer science literature (Kraus et al., 2020). Its breadth ensures the inclusion of both technical and consumer-focused studies, thereby enabling a holistic mapping of the field.

The search strategy was designed to capture publications that explicitly integrate three thematic axes:

1. Dynamic pricing and algorithmic price optimisation
2. Artificial Intelligence and machine learning methodologies
3. Ethics, transparency, and consumer trust

The final query was:

(TITLE-ABS-KEY("dynamic pricing" OR "personalized pricing" OR "price optimization" OR "algorithmic pricing") AND TITLE-ABS-KEY("artificial intelligence" OR "machine learning" OR "deep learning" OR "reinforcement learning" OR "algorithmic"))

AND TITLE-ABS-KEY("fairness" OR "price fairness" OR "transparency" OR "algorithmic transparency" OR "trust" OR "consumer trust" OR "consumer protection" OR "ethics" OR "algorithmic ethics"))

AND PUBYEAR > 2000

AND (LIMIT-TO(DOCTYPE, "ar") OR LIMIT-TO(DOCTYPE, "re"))
AND (LIMIT-TO(LANGUAGE, "English"))

This formulation ensured thematic precision while avoiding the inclusion of tangential works that address only one or two of the axes without explicitly linking them.

Data processing and cleaning

The dataset was exported in CSV format, including bibliographic information, abstracts, keywords, and references. Duplicate records were removed, and author keywords were standardised to consolidate variants (e.g., *AI* and *artificial intelligence*). This normalisation process mitigates the fragmentation of terms, which is particularly important in emerging domains where keyword usage has not yet stabilised.

Analytical techniques and software

The analysis was conducted using two complementary tools:

- **VOSviewer** (Van Eck & Waltman, 2013) for network visualisations of keyword co-occurrence, co-citation patterns, and overlay temporal mapping.
- **Biblioshiny** (Lim et al., 2024) for thematic mapping, thematic evolution analysis, and descriptive performance indicators.

The methodological workflow involved:

- **Performance analysis:** quantifying publication trends, most productive journals, authors, and countries.
- **Conceptual structure analysis:** identifying thematic clusters through keyword co-occurrence networks.
- **Thematic evolution analysis:** tracking the transition from optimisation-centric to ethics-centric discourse over time.
- **Collaboration network analysis:** mapping international co-authorship patterns to identify geographical research hubs.

Thresholds for inclusion in network maps were determined to balance coverage and clarity, e.g., a minimum of three keyword occurrences for inclusion in co-occurrence maps.

Methodological positioning

The approach adopted recognises that bibliometric studies in nascent fields must account for low publication volumes without sacrificing analytical rigour. In such cases, the emphasis shifts from exhaustive coverage to the precision of thematic delineation and the interpretive depth of conceptual mapping. By applying multi-level bibliometric techniques to a carefully delimited corpus, this study aims to generate insights that are both representative of the current knowledge base and instructive for shaping future research trajectories.

Analysis and results

Descriptive performance analysis

The dataset comprises **38 peer-reviewed articles** published between 2019 and 2025, sourced from **34 distinct journals** and authored by **122 individual researchers**. The average number of co-authors per document is **3.29**, with **28.95 %** of the publications involving international collaboration. This reflects a moderately interconnected scholarly community, with a collaborative structure typical of early-stage interdisciplinary domains.

In terms of citation impact, the corpus shows an **average of 10.29 citations per document**, which is noteworthy for a research niche less than a decade old in substantive output. The **annual growth rate of**

22.22 % underscores the accelerated scholarly attention to the intersection of dynamic pricing, Artificial Intelligence, and ethical considerations (see Fig. 1).

Table 1 reports the most productive authors in this emerging field, together with their primary institutional affiliations and countries. Three scholars—Liang Y., Liu Y., and Sears A.M.—each contribute two articles to the corpus, while the remaining highly productive authors are single-contribution specialists. The geographical distribution of leading authors is skewed towards Chinese institutions, which account for three of the ten most productive scholars, followed by universities in the United States, with two representatives. Additional key contributors are based in the Netherlands, the Philippines, Turkey, Pakistan, and Iran, underscoring that research on AI-driven dynamic pricing, ethics, and transparency is developing through a small but internationally dispersed

Table 1
Key contributing authors, their affiliations and countries.

Author	Documents	Affiliation (first listed)	Country
Liang Y.	2	School of Computer and Communication Engineering, University of Science and Technology Beijing, Beijing	China
Liu Y.	2	School of Computer Science and Engineering, South China University of Technology, Guangzhou	China
Sears A.M.	2	Centre for Law and Digital Technologies (eLaw), Leiden University, Leiden	Netherlands
Aguas R. D., Jr.	1	School of Industrial Engineering and Engineering Management, Mapúa University, Manila	Philippines
Akella L.Y.	1	Tuck School of Business, Dartmouth College, Hanover, NH	United States
Alper G.	1	Faculty of Economics and Administrative Sciences, Ankara Haci Bayram Veli University, Ankara	Turkey
Ascarza E.	1	Marketing Unit, Harvard Business School, Harvard University, Boston, MA	United States
Asim M.	1	Department of Computer Sciences, National University of Computer and Emerging Sciences, Islamabad	Pakistan
Ayepah-Mensah D.	1	School of Computer Science and Engineering, University of Electronic Science and Technology of China, Chengdu	China
Azmi P.	1	Department of Electrical and Computer Engineering, Tarbiat Modares University, Tehran	Iran

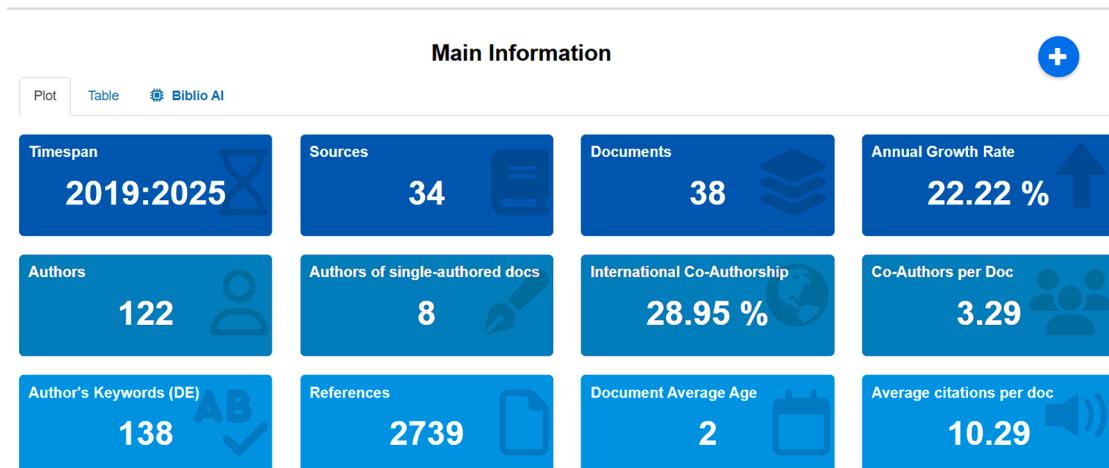


Fig. 1. Main bibliometric indicators for the corpus, including sources, authorship patterns, collaboration rates, and citation impact.

community of authors.

Annual scientific production

The annual output trajectory shows an inflection point in 2022, with a sustained production of 10 publications per year through 2024 and 2025 (see Fig. 2). This stability may indicate a consolidation of the topic as a recognised niche, yet it could also signal a thematic saturation within its current boundaries. The timing coincides with heightened policy activity, notably the drafting of the EU *Artificial Intelligence Act*, suggesting a policy-publication feedback loop. Compared to related bibliometric mappings on AI ethics more broadly, the growth rate here appears more concentrated and reactive to regulatory developments, underlining the importance of external drivers in shaping scholarly output.

Conceptual structure: co-occurrence of author keywords

The co-occurrence network of author keywords reveals two dominant thematic groupings (see Fig. 3). The first cluster, coloured in red, centres on terms such as *algorithmic pricing*, *personalized pricing*, and *price discrimination*, indicating a focus on pricing mechanisms and their distributive consequences. The second cluster, coloured in green, is anchored by *dynamic pricing* and *artificial intelligence*, reflecting the technological and methodological core of the field.

The strong linkages between clusters suggest that ethical concerns are increasingly integrated into the technical discourse on AI-enabled pricing. Notably, the proximity of *price discrimination* to *algorithmic pricing* implies that discussions of fairness are not peripheral but structurally embedded in pricing algorithm research.

To strengthen the link between the conceptual framework outlined in Section 2 and the bibliometric results, Table 2 maps each theoretical block to the corresponding clusters and keywords identified in the co-occurrence analysis. This alignment exercise makes it possible to assess the extent to which the intellectual architecture of the field, as constructed in the literature, is reflected in the actual patterns of scholarly output.

From this mapping, it becomes evident that the strongest thematic alignment exists between the technological core of dynamic pricing and its bibliometric representation, while the normative and regulatory dimensions—although present—remain comparatively less central in the keyword network. This suggests that, despite increasing scholarly attention to fairness, transparency, and governance, these ethical constructs have yet to achieve the same structural prominence as technical concepts in the AI-driven dynamic pricing discourse.

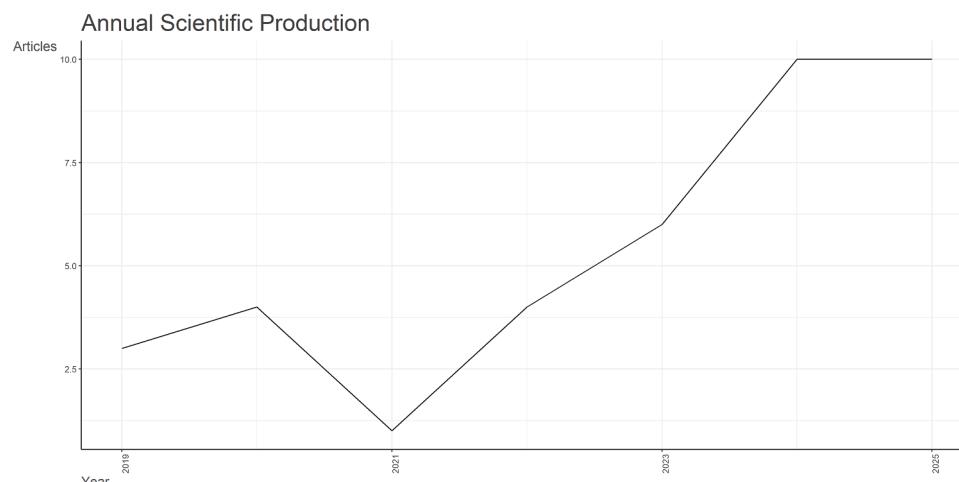


Fig. 2. Annual scientific production for the period 2019–2025, showing significant acceleration from 2021 onwards.

Intellectual structure: co-citation analysis

The co-citation structure (see Fig. 4) is anchored by three disciplinary pillars: behavioural economics (e.g., Haws & Bearden), legal–policy scholarship (e.g., Zuiderveld Borgesius & Poort), and marketing science (e.g., Xia, Monroe & Cox). The presence of these anchors confirms the field's interdisciplinary foundation. The relative proximity of these clusters indicates a degree of conceptual cohesion; however, the density of intra-cluster connections is higher than inter-cluster linkages, suggesting a risk of thematic siloing. Stronger integration between legal–policy and behavioural economics literatures, for instance, could enhance the explanatory richness of models that connect consumer perception with regulatory compliance.

Thematic mapping

The thematic map (see Fig. 5) positions *algorithmic pricing*, *personalized pricing*, and *price discrimination* as motor themes, combining high centrality with high density—indicative of their centrality to the research agenda and sustained internal development. These topics anchor the discourse and are unlikely to lose relevance in the near term. *Dynamic pricing* and *artificial intelligence* occupy the basic themes quadrant, suggesting that, while foundational, their thematic maturity is lower and may require further conceptual refinement in this specific ethical context. The presence of *adversarial machine learning* as a niche theme is noteworthy: while currently peripheral, its potential to address vulnerabilities and fairness challenges in pricing algorithms could elevate it to motor theme status if integrated into the mainstream research agenda. The emerging/declining themes quadrant contains generic terms such as *pricing strategy*, which may be undergoing a reframing towards more specialised terminology aligned with ethical AI discourse.

Thematic evolution

The thematic evolution of the corpus reveals a discernible chronological transition from a predominantly technical discourse—focused on algorithmic optimisation and predictive modelling—towards a more normative agenda in which fairness, transparency, and consumer trust progressively assume central importance. This shift is not incidental; rather, it is driven by identifiable policy, technological, and sector-specific developments.

The early stage (2019–2020) was dominated by methodological terms such as *dynamic pricing*, *machine learning*, and *price optimisation*, reflecting a research agenda primarily concerned with computational efficiency and predictive accuracy. Ethical constructs were either absent

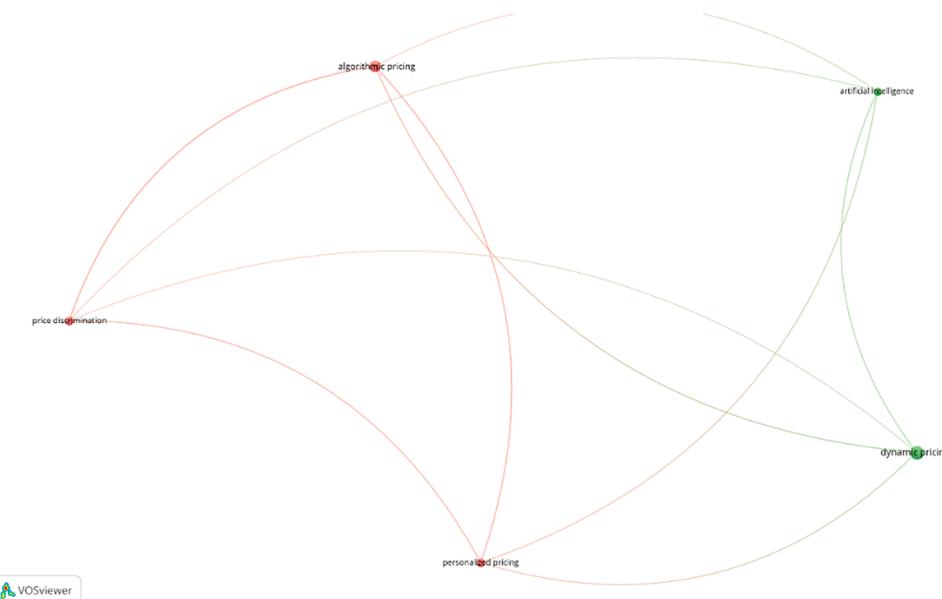


Fig. 3. Co-occurrence network of author keywords, highlighting two major thematic clusters: pricing mechanisms with ethical implications (red) and AI-enabled dynamic pricing methodologies (green).

Table 2
Mapping between the theoretical framework and co-occurrence clusters.

Theoretical block	Key concepts from theoretical framework	Cluster/Keywords detected in co-occurrence	Observations and alignment
2.1 Dynamic Pricing and AI in Contemporary Markets	Dynamic pricing, AI, machine learning, deep learning, reinforcement learning, price optimisation	dynamic pricing, artificial intelligence, algorithmic pricing, personalized pricing	High alignment: these terms constitute the core of the green cluster (methodology and technology).
2.2 Price Fairness and Algorithmic Ethics	Price fairness, distributive fairness, procedural fairness, bias mitigation, algorithmic ethics	price fairness, price discrimination, ethics, consumer protection	Medium-high alignment: fairness and consumer protection appear as emerging concepts within the red cluster.
2.3 Transparency, Interpretability, and Consumer Trust	Transparency, interpretability, explainable AI (LIME, SHAP), trust, procedural fairness	transparency, trust, consumer trust, explainable AI	Medium alignment: transparency and trust are present, but with lower density compared to technical terms.
2.4 Regulatory and Policy Frameworks	AI Act, FTC guidelines, OECD principles, high-risk classification, governance, accountability	consumer protection, ethics, algorithmic governance	Low-medium alignment: regulatory connections are visible but not yet central in co-occurrence networks.

Source: Own elaboration.

or marginal, rarely intersecting with the technical research core.

A transitional phase emerges in 2021–2022, coinciding with the European Commission's publication of the draft *Artificial Intelligence Act* (April 2021) and subsequent deliberations in the European Parliament. The introduction of terms such as *price fairness*, *consumer protection*, and

transparency into the academic discourse parallels the diffusion of regulatory language into scholarly enquiry. Parallel developments—most notably the OECD's reinforcement of its *Principles on AI* and the Federal Trade Commission's guidance on algorithmic discrimination—further embedded these normative concerns within the research landscape.

From 2023 onwards, a consolidation phase is observed, in which ethical and regulatory keywords become structurally integrated into the co-occurrence network, often functioning as bridging nodes between technological and normative clusters (see Fig. 3). This reflects not only an academic reorientation but also the maturation of industry practice. The adoption of *fairness-aware algorithms* and explainability frameworks (e.g., SHAP, LIME) in e-commerce and ride-hailing platforms has amplified scholarly interest in consumer trust. Sectoral controversies—such as public debates over *surge pricing* in post-pandemic transport markets—have acted as both empirical catalysts and legitimacy tests for AI-driven dynamic pricing models.

Overall, the thematic trajectory suggests a process of normative embedding, in which the technical lexicon and ethical governance language are increasingly intertwined. Transitional keywords such as *price discrimination* and *consumer protection* now operate as conceptual anchors, signalling the integration of distributive and procedural justice considerations into the core research agenda.

Alignment with research questions

The first research question sought to understand how concepts related to fairness, transparency, and trust have emerged and evolved within the AI-driven dynamic pricing literature. The results clearly indicate an upward trend in these concepts from 2022 onwards, confirming their growing salience. Thematic mapping and temporal analysis show that such terms are increasingly embedded in core research clusters rather than remaining isolated topics.

The second research question addressed the extent to which scholarly contributions explicitly link algorithmic pricing mechanisms with consumer protection concerns. Evidence from co-occurrence and thematic maps reveals direct conceptual linkages between technical terms (*algorithmic pricing*, *personalized pricing*) and normative constructs (*price discrimination*, *consumer protection*). This suggests that, while still developing, an integrative discourse is emerging that bridges technical optimisation with consumer rights.

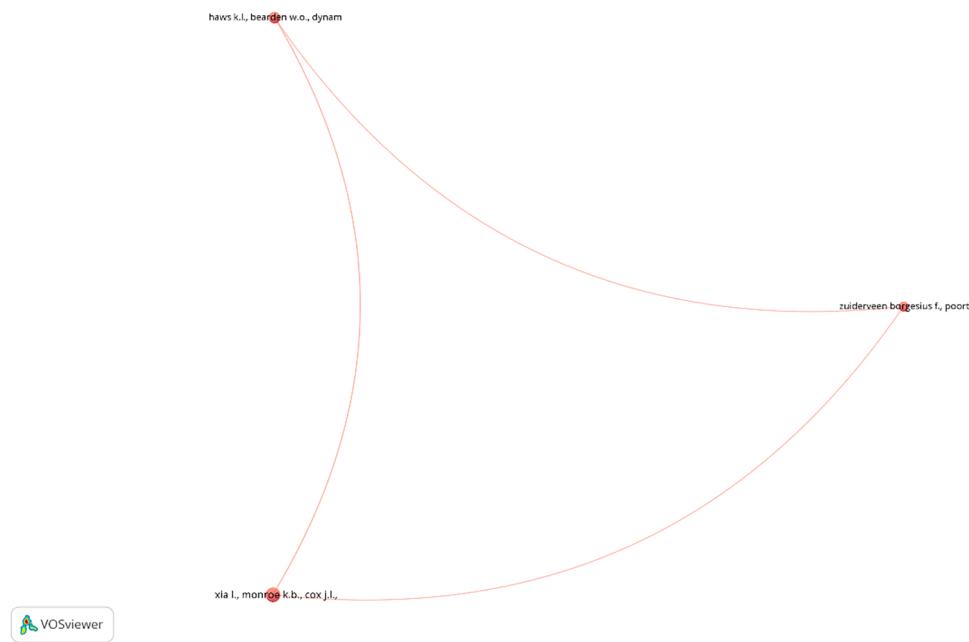


Fig. 4. Co-citation network of cited references, showing the convergence of behavioural economics, legal policy, and marketing science in the foundational literature.

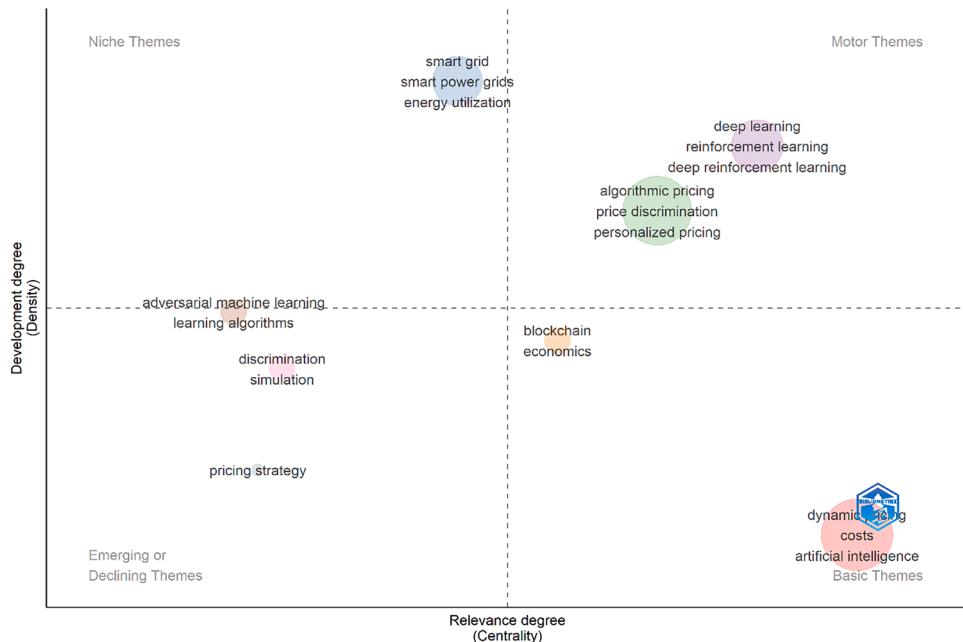


Fig. 5. Thematic map positioning key concepts by centrality and density, distinguishing motor themes, basic themes, niche themes, and emerging/declining topics.

The third research question examined which research communities and geographical clusters are most active in integrating ethical considerations into dynamic pricing discourse. The collaboration metrics and co-authorship patterns, though limited by the niche size of the corpus, reveal participation from diverse regions and an increasing proportion of international collaborations (28.95 %). These findings suggest the early stages of a transnational research community addressing both the technical and ethical dimensions of dynamic pricing.

These findings underscore the interplay between technological innovation, normative discourse, and external policy stimuli in shaping the intellectual structure of AI-driven dynamic pricing research. The following section discusses the theoretical, practical, and regulatory

implications of these results, positioning them within broader debates on algorithmic governance and consumer protection.

Summary and interpretation of main empirical findings

Taken together, the performance indicators, science-mapping techniques, and thematic evolution analysis reveal a small but rapidly consolidating research niche. The corpus of 38 journal articles published between 2019 and 2025 exhibits an early exploratory phase followed by a marked acceleration after 2021, coinciding with heightened regulatory and public debate around the EU *Artificial Intelligence Act* and related soft-law initiatives. The combination of sustained growth in

publications, non-trivial citation impact, and increasing international collaboration suggests that AI-driven dynamic pricing is no longer treated as a purely technical optimisation problem, but as a strategic and ethical issue.

The conceptual and intellectual structures provide further nuance. Co-occurrence of author keywords consistently yields two tightly connected clusters: one centred on algorithmic and optimisation terminology, and another centred on fairness, transparency, and consumer trust. Co-citation patterns mirror this duality, with three partially overlapping poles grounded in operations research and computer science, behavioural and consumer research, and legal-regulatory scholarship. The strong bridges between these poles indicate that ethical requirements are beginning to be treated not as exogenous constraints, but as design parameters that must be integrated into model development, validation, and deployment.

Thematic mapping and evolution reinforce this interpretation. Algorithmic pricing and personalisation remain motor themes, yet they are increasingly articulated through the language of explainability, accountability, and compliance. Over time, topics such as discrimination, opacity, and consumer protection move from peripheral or niche status towards the core of the field, particularly in studies that explicitly engage with regulatory standards or entrepreneurial adoption. In these contributions, firms are framed both as protagonists of innovation in dynamic pricing and as boundary cases for testing how far ethical and legal safeguards can or should travel.

Overall, the empirical evidence points to a normative turn in research at the intersection of entrepreneurship, ethics, and AI-driven dynamic pricing. Rather than simply documenting performance gains, recent work interrogates how algorithmic design choices affect perceptions of legitimacy, price fairness, and trust, and how regulatory and industry standards can shape these choices *ex ante*. These patterns provide the empirical foundation for the theoretical, practical, and policy implications elaborated in the subsequent discussion section.

Discussion

The results confirm that the technical core of the domain—predictive performance, computational efficiency, and revenue optimisation—remains structurally dominant, while becoming less insulated from normative debate. The proximity between algorithmic pricing concepts and terms such as price discrimination and consumer protection suggests that distributive consequences are now discussed within, rather than outside, optimisation logics. Nonetheless, integration between behavioural perspectives (perceived price fairness, transparency, and trust) and technical model specification remains incomplete: a degree of fragmentation persists between consumer-facing studies of fairness perceptions and technically-oriented work that still treats ethics primarily as a constraint.

The observed “normative turn” is further illuminated by regulatory and policy scholarship. After 2022, consumer-protection and governance vocabularies increasingly act as bridging elements between technical and normative clusters, in a context of intensified debate on trustworthy AI and accountability associated with frameworks such as the EU *Artificial Intelligence Act*. In this domain, regulation is not merely a downstream constraint; it operates as an upstream driver that helps redefine what counts as a relevant variable in AI-enabled pricing research—particularly explainability, accountability, documentation, and oversight.

Entrepreneurship emerges as a consequential boundary condition. Start-ups and new ventures may be early adopters of AI-enabled pricing due to organisational agility, yet they face disproportionate legitimacy and reputational risks when pricing is perceived as opaque or discriminatory. While the entrepreneurial dimension is not yet central in the keyword network, it signals a clear opportunity for theory building through more stable, operationalised constructs. The intellectual structure, anchored in behavioural economics, marketing, and legal policy

scholarship, confirms both the interdisciplinary promise of the field and the continuing risk of siloing: advances in audit standards, disclosure obligations, and governance frameworks are unlikely to translate into higher consumer trust unless they are connected to credible behavioural models of fairness perceptions and to technically meaningful notions of interpretability and bias.

Theoretical implications

The findings of this study contribute to the theoretical maturation of AI-driven dynamic pricing by evidencing the convergence of technical and normative discourses within a previously fragmented literature. The co-occurrence and thematic evolution analyses reveal that ethical constructs—*fairness*, *transparency*, and *trust*—are no longer peripheral concerns but increasingly occupy structurally central positions in the conceptual network.

From a disciplinary standpoint, this signals the emergence of a hybrid research domain that draws equally from computational optimisation, behavioural economics, and legal policy scholarship. Theoretical models of dynamic pricing can no longer afford to isolate efficiency metrics from behavioural responses or normative constraints. Instead, an integrated framework is required, one that incorporates algorithmic interpretability, consumer perception metrics, and compliance considerations as core variables in model design and evaluation.

This integration also invites a rethinking of established constructs. For example, *price fairness*, traditionally operationalised as a perceptual variable, must now be modelled in conjunction with algorithmic decision rules and data provenance, enabling a more precise linkage between consumer responses and the underlying technical mechanisms. Similarly, *consumer trust* in AI pricing should be theorised as a function of both disclosure practices and the verifiability of system outputs.

Practical implications

For practitioners, these results underscore the strategic necessity of embedding ethical and transparency considerations into AI-driven pricing systems from inception rather than as post-hoc adjustments. The presence of *price discrimination* and *consumer protection* within motor themes indicates that industry actors must proactively manage reputational and compliance risks associated with opaque or discriminatory pricing practices.

Operationally, this calls for the adoption of explainable AI (XAI) tools that can provide both model-level interpretability for internal governance and decision-level explanations for end-users. Companies should also invest in fairness-aware machine learning pipelines capable of detecting and mitigating biases during both training and deployment phases.

From a competitive standpoint, integrating ethical safeguards is likely to evolve from being a compliance cost to becoming a market differentiator. Firms that can demonstrate robust transparency mechanisms may not only pre-empt regulatory sanctions but also enhance customer loyalty, particularly in sectors where pricing algorithms directly shape consumer trust, such as e-commerce, mobility services, and travel.

Regulatory and policy implications

The temporal clustering of ethical keywords in the post-2022 literature aligns with the trajectory of global AI governance debates. The emergence of *consumer protection* as a connected keyword within the core network suggests that academic discourse is anticipating, and potentially shaping, regulatory frameworks such as the European Union’s *Artificial Intelligence Act* and the OECD’s *Principles on AI*.

For policymakers, the findings highlight the necessity of integrating technical literacy into regulatory design. Governance mechanisms that merely mandate transparency without specifying interpretability

standards risk producing compliance theatre rather than substantive accountability. Regulations should therefore define minimum criteria for algorithmic explainability, bias auditing, and consumer recourse mechanisms.

The international collaboration patterns observed, while still modest, suggest the potential for cross-jurisdictional harmonisation of standards. Given the global reach of digital marketplaces, fragmented regulation may incentivise regulatory arbitrage, undermining consumer protection goals. A coordinated approach, potentially under the aegis of transnational bodies, would enhance both enforcement capacity and market predictability.

Conclusion

This study has provided the first bibliometric mapping of the ethical agenda within AI-driven dynamic pricing, systematically examining the interplay between algorithmic optimisation, normative imperatives, and consumer-centric outcomes. By analysing a focused corpus of 38 peer-reviewed articles published between 2019 and 2025, the research captures a field in the process of definition, one where disciplinary boundaries are dissolving and conceptual priorities are rapidly evolving.

For the academic community, the findings establish a consolidated baseline from which to theorise the inseparability of technical performance and ethical acceptability in pricing systems. The transition from a purely optimisation-centric discourse to one in which fairness, transparency, and trust are thematically central suggests that future scholarship must adopt integrative models that bridge computational, behavioural, and regulatory perspectives.

For industry practitioners, the results highlight both the risks and opportunities inherent in deploying AI-enabled pricing. Ethical safeguards, transparency protocols, and fairness-aware algorithms are no longer optional add-ons; they are strategic imperatives that can differentiate market leaders from laggards. Firms that can operationalise explainability and equity in their pricing systems are likely to enjoy competitive advantages in consumer trust, regulatory resilience, and brand reputation.

For policymakers and regulators, the study underscores the urgency of aligning governance frameworks with the technical realities of AI pricing. Effective regulation must move beyond broad ethical principles to establish enforceable standards for transparency, bias auditing, and consumer recourse. Given the global nature of digital markets, harmonised international guidelines are essential to avoid regulatory arbitrage and ensure equitable treatment across jurisdictions.

Ultimately, the convergence of technical innovation and ethical accountability in dynamic pricing represents both a challenge and an opportunity. This bibliometric analysis has illuminated the contours of an emergent research domain whose societal relevance will only intensify in the coming decade. By mapping its conceptual architecture and thematic evolution, the study provides a foundation for the next generation of scholarship, corporate practice, and policy intervention, ensuring that the future of dynamic pricing is not only intelligent but also just.

Limitations and future research

Limitations

The first limitation identified in this research is that this study is based on 38 peer-reviewed articles, a corpus size consistent with the nascent maturity of the field. While this inevitably constrains the granularity of cross-comparative analyses across subfields or sectors, it accurately reflects the characteristics of an emerging niche rather than representing a methodological shortcoming. The limitation is mitigated through the adoption of a relational and evolutionary analytical approach. Furthermore, the dataset was drawn exclusively from Scopus, restricted to publications in English and to specific document types

(articles and reviews). This scope may omit relevant literature disseminated through conference proceedings (e.g., IEEE/ACM), non-English publications (e.g., Spanish, Portuguese, Chinese), or grey literature (regulatory reports, standards documentation). Consequently, the results may exhibit a bias towards English-speaking communities and established journal outlets.

Another limitation is related to the conceptual networks, built primarily from author-supplied keywords, which are subject to terminological variation and heterogeneous editorial practices. While normalisation was undertaken, there remains a risk of underestimating conceptual linkages when equivalent concepts are labelled differently (e.g., *price fairness* vs *pricing fairness*). In addition, the results may be sensitive to technical parameters, such as occurrence thresholds, full versus fractional counting, periodisation choices, and community detection algorithms. Conservative parameter settings were applied to maximise transparency and reproducibility, yet robustness checks through sensitivity analysis remain desirable. Finally, the research may have a proactive perspective. These limitations point directly towards clear research opportunities: expanding sources and languages, incorporating conference and grey literature, and combining bibliometric mapping with experimental and quasi-experimental methods to link algorithmic mechanisms to behavioural and regulatory outcomes.

Future research

As future lines of research, the first focuses on broadening the data ecosystem, extending the coverage to Web of Science, IEEE Xplore, ACM DL and SSRN, integrating conference proceedings in AI and HCI where transparency and XAI practices often emerge. In addition, future research should include non-English sources (e.g., Spanish, Portuguese, Chinese) to capture regulatory frameworks and localised applications and incorporate grey and regulatory literature (competition/consumer authority rulings, algorithmic audit guidelines, impact assessments). The second suggested future line of research is about methodological enrichment, applying dynamic topic modelling (e.g., DTM, BERTopic) to titles and abstracts to trace semantic trajectories of fairness, transparency, and trust. Future researchers could also construct temporal multilayer networks combining keyword co-occurrence, co-citation, and co-authorship to identify interdisciplinary brokers, conduct systematic sensitivity analyses (thresholds, fractional counting, varying temporal windows) and report these as reproducible appendices. Also, bridging theory and mechanism: integrated explanatory models. We also recommend operationalising *price fairness* by linking algorithmic decision rules (variables used, weighting, thresholds) to consumer perceptions, enabling mediational models (transparency → perceived fairness → trust → purchase intention). Researchers could explore contextual moderators (sector, urgency, scarcity, real-time sensitivity) and heterogeneity (economic vulnerability, digital literacy). Finally, one needs to consider, the reproducibility and openness to publish replication packages (code and anonymised metadata), specifying pre-analysis plans, adopting reporting checklists (sources, filters, thresholds, algorithms) and fostering multi-stakeholder consortia (academia–industry–regulator) to share synthetic datasets that enable comparable testing of pricing algorithms and fairness metrics.

So, future research should broaden empirical scope, deepen causal enquiry, and operationalise algorithmic governance in pricing. By combining advanced bibliometrics, NLP, causal inference, and audit standards, the field can progress from mapping the agenda to engineering solutions that ensure dynamic pricing systems are both intelligent and just.

CRediT authorship contribution statement

Ana Paloma de Lucas López: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Alexandra Eugenia Gorneanu:** Writing – original draft, Methodology,

Investigation, Formal analysis, Data curation, Conceptualization. **Alba Yela Aránega:** Writing – review & editing, Supervision. **Lucía Gallego Martín:** Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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