Gestão & Sociedade
REVISTA ELETRÔNICA

ISSN 1980-5756 | DOI: 10.21171/ges.v19i53.3747
v.19, n.53, p. 5974-5994| Janeiro/Abril – 2025
Sistema *Double Blind Review*

NETWORK EXTERNALITY (NE) IN THE DIGITAL AND INFORMATION TECHNOLOGY MARKET: A SYSTEMATIC REVIEW

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Submetido em 28 de novembro de 2022
Aprovado em 13 de Dezembro de 2025

Gestão & Sociedade
REVISTA ELETRÔNICA

ABSTRACT

Network externalities play a central role in the adoption and diffusion of digital and information technologies, as the value of a technology increasingly depends on the size and composition of its installed user base. Despite a long-standing theoretical tradition, empirical findings on network externalities remain fragmented across disciplines and application contexts. This study addresses this gap by conducting a systematic literature review of empirical research on network externalities in the context of innovation, digital technologies, and disruptive technologies. Articles were retrieved from the Web of Science, Scopus, and ScienceDirect databases using predefined search strings and selection criteria, resulting in a final sample of 14 high-impact empirical studies. The review synthesizes prior findings by organizing the literature according to areas of application, research objectives, and key outcomes, without claiming original empirical identification of the phenomenon. The results show that network externalities generate both positive and negative effects on technology adoption, market dynamics, and value capture, depending on factors such as compatibility, complement availability, pricing strategies, and social influence mechanisms. Based on this synthesis, the study proposes an installed-base-driven network externality framework that integrates technical compatibility and social amplification mechanisms to explain adoption dynamics. This framework contributes to theory by clarifying the conditions under which network externalities enhance diffusion while constraining firm profitability, and by delineating boundary conditions for future research and managerial application.

Keywords: network externalities; digital platforms; technology adoption; systematic literature review; network effects.

1 Introduction

The concept of network externalities emerged in economics to denote situations in which the value of a product increases as the number of adopters grows (Rohlfs, 1974). In this sense, network externalities are closely related to what is commonly discussed as network effects: demand and individual utility are shaped by the set of choices made by other agents connected to a given good or factor (Britto, 2006). Katz and Shapiro (1985) formalized this logic by arguing that consumer utility depends on the presence of other consumers in the same network.

In contemporary digital markets, however, network externalities have become both more consequential and more complex. Digital platforms, multi-sided markets, and rapidly evolving infrastructures create dynamic interactions among users, complements, and compatibility standards, which continuously reshape adoption incentives. Recent research has also emphasized the need to operationalize and measure network effects across multiple dimensions, such as ecosystem utility, complementarity, and compatibility, especially in technology-intensive environments (Schüler and Petrick, 2023). These characteristics help explain why the "network externalities dilemma" remains relevant: technological innovation is continuous, competitive landscapes change rapidly, and network effects are often context-dependent (varying across industries, products, and regions), creating persistent theoretical and managerial challenges.

Because of these dynamics, understanding network externalities is central to explaining technology acceptance, diffusion, and adoption, particularly for platforms and digital products whose value proposition depends on collective uptake. Examples include social networks, digital payment ecosystems, mobile devices, and software-based solutions. In general, network externalities are more likely to be decisive when interconnection patterns and compatibility across components are critical to expanding functional performance (Britto, 2006).

Despite the maturity of the foundational theory, the literature remains fragmented across domains (economics, business, marketing, information systems), and the mechanisms linking network externalities to individual/consumer behavior in technology adoption are dispersed across empirical contexts. This fragmentation creates

an important gap: scholars and practitioners still lack an integrated view that (i) consolidates what is known about the antecedents and consequences of network externalities in technology adoption settings, (ii) identifies boundary conditions explaining divergent findings, and (iii) organizes this evidence into a framework capable of guiding future research and decision-making.

Accordingly, this study addresses the following research problem: How has the literature discussed network externalities in empirical studies focused on the adoption of new technologies? The purpose of this paper is to systematically synthesize peer-reviewed research on network externalities in technology adoption contexts and propose an integrative framework that clarifies mechanisms, relevant contingencies, and implications. In doing so, the study contributes to contemporary research frontiers by organizing an evolving body of knowledge that is increasingly influenced by digital platforms, ecosystem competition, and fast-paced technological change (Schüler and Petrick, 2023).

Methodologically, this article is a structured systematic literature review (SLR), not a bibliometric analysis, designed to map, synthesize, and critically integrate the state of the art. To strengthen transparency and replicability, we follow established guidance for conducting and reporting systematic reviews (e.g., PRISMA) and broader methodological discussions about literature reviews as rigorous research methodologies (Page, 2020; Snyder, 2019) The review evidence is then consolidated into an analytical framework that supports future empirical testing and theory development, as well as managerial strategies to manage and leverage network externalities effectively.

2 Concepts about network externalities

The literature commonly defines network externalities as situations in which the value (and, consequently, the demand) for a product or service increases with the size of its installed base (Rohlfs, 1974). In technology markets, this phenomenon is particularly relevant because adoption decisions are rarely independent: users often evaluate a technology not only by its intrinsic attributes, but also by the expected participation of others in the same network (Katz and Shapiro, 1985).

A useful way to organize the discussion is to distinguish direct and indirect network externalities (Katz and Shapiro, 1985). Direct network externalities arise when additional users directly increase the utility of the product to each user—classic examples include communication technologies such as telephony: having a single telephone would be of limited value, whereas utility increases as more people join the network (Farrell and Saloner, 1985). Indirect network externalities, in turn, occur when product value is mediated by the availability and variety of complementary goods and services. For example, a broader supply of compatible CDs increases the value of CD players, even though it does not add "users" to the hardware network itself (Basu et al., 2003).

Once an adoption cycle begins, both types of externalities may generate benefits for new and existing users through several mechanisms: (i) lower prices associated with standardization, scale economies, competition, and firms' incentives to accelerate adoption (Farrell and Saloner, 1985; Brynjolfsson and Kemerer, 1996); (ii) reduced uncertainty about future versions, upgrades, and continuity (Padmanabhan et al., 1997); (iii) a larger user base that provides informal support, content creation, and information exchange (Westland, 1992; Watanabe and Hobo, 2004); (iv) quality improvements associated with learning and feedback cycles (Redmond, 1991; Bental and Spiegel, 1995); (v) expansion and increased competition in complementary markets (Farrell and Saloner, 1985; Cottrell and Koput, 1998); and (vi) reduced uncertainty about the availability of future complements and services (Padmanabhan et al., 1997).

At the same time, the literature also recognizes that network externalities are not unconditionally beneficial. As networks grow, congestion and overload effects may emerge, indicating that increases in installed base or complement availability can generate negative outcomes for users and the system (Hellofs and Jacobson, 1999; Strader, Ramaswami and Houle, 2007). This duality sustains a central dilemma: under what conditions do network externalities accelerate adoption and welfare, and under what conditions do they hinder diffusion, reduce user experience, or distort competition?

Pricing dynamics illustrate this dilemma particularly well. On the supply side, firms often have incentives to set an initially low price to trigger adoption and capture value later in the diffusion cycle (Rohlfs, 1974; Katz and Shapiro, 1986). On the demand side, consumers may anticipate price declines as production scales and the installed base

expands (Katz and Shapiro, 1986). As a result, while price reductions can stimulate early adoption, they can also postpone profitability and create a "low-price ceiling" that reshapes firms' incentives over time.

Finally, the literature suggests that changing product attributes is especially challenging in networked settings, because modifications may ripple through complementors and compatibility requirements, affecting not only focal firms but also suppliers of complementary goods and services (Staudenmayer et al., 2005). Moreover, "waiting" can be strategic—allowing uncertainty to be resolved—but it can also enable competitors to emerge and intensify obsolescence risks, ultimately affecting project returns.

Taken together, these mechanisms show why network externalities remain a persistent and timely research topic in technology adoption: outcomes depend on market dynamics, complements, compatibility standards, and heterogeneous user segments. For instance, different adopter categories (e.g., early adopters vs. late adopters) may respond differently to network signals and social influence, which warrants caution when interpreting empirical evidence across contexts.

3 Methodology

The aim of this study is to synthesize empirical evidence on how network externalities influence the adoption and diffusion of innovative technologies. To achieve this goal, we conducted a structured systematic literature review (SLR), emphasizing qualitative integration and synthesis, in which interconnections between theories and empirical findings are articulated to support framework development (Finfgeld-Connett, 2013).

Table 1. Review protocol and research organization framework (Structured SLR)

Stage	Step	Procedure description
(1) Identification	1.1	Selection of databases (Web of Science, Scopus, ScienceDirect)
	1.2	Definition of keywords and search strings (network externalit* + technology adoption/diffusion terms)
	1.3	Search execution (title/abstract/keywords) and export of records
(2) Screening & Eligibility	2.1	Consolidation of records and reference management (spreadsheet)
	2.2	Duplicate removal across databases
	2.3	Title and abstract screening based on inclusion/exclusion criteria (centrality of NE + technology adoption/diffusion context + empirical study)
	2.4	Full-text eligibility assessment (confirm construct centrality, empirical focus, and relevance to the research question)
(3) Synthesis	3.1	Data extraction (context, objectives, theory, operationalization, antecedents, consequences, key findings)

3.2 Qualitative thematic coding and integrative synthesis (mechanisms, boundary conditions, outcomes)
3.3 Framework development and articulation of relationships among dimensions

Source: Adapted from Prado et al. (2016), reorganized to align with a structured systematic literature review protocol and PRISMA-style reporting.

To ensure transparency and replicability, we organized the review into three stages, identification, screening/eligibility, and synthesis, as summarized in Figure 1, and we report the selection flow using a PRISMA-style diagram.

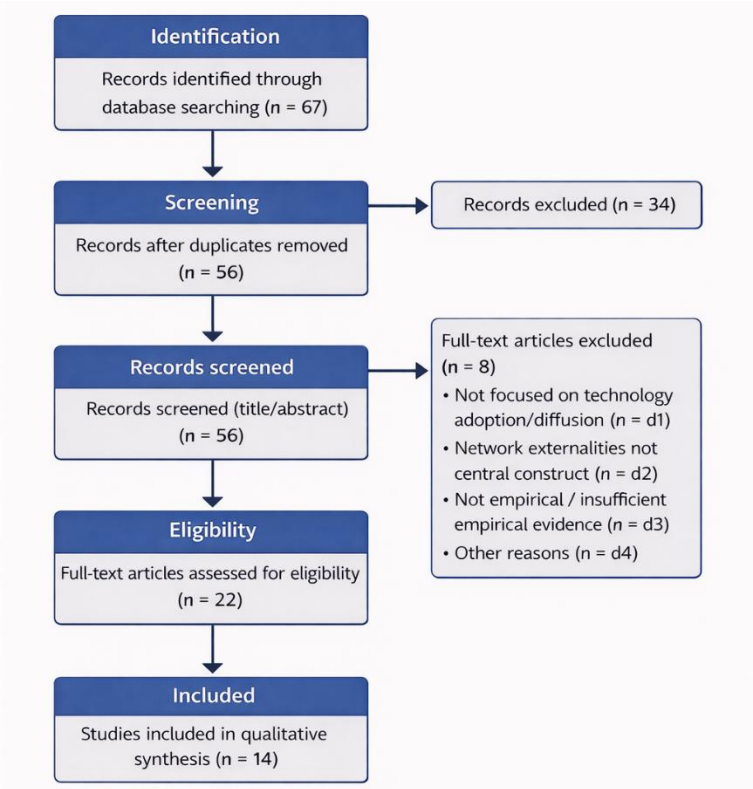

Figure 1. PRISMA flow diagram of the review process
Source: Adapted from Prado et al. (2016), reorganized to align with a structured systematic literature review protocol and PRISMA-style reporting.

In the following subtopic, each step of the analysis framework will be explained in more detail. Specifying the inclusion and exclusion criteria of articles in this systematic review.

3.1 Identification: databases and search strategy

We searched three bibliographic databases—Web of Science, Scopus, and ScienceDirect—to capture peer-reviewed research across multiple disciplines. The search strings combined the field term "network externalit"* with technology-related terms associated with innovation and diffusion (e.g., "innovation technolog*", "disruptive technolog*", "new technolog*"). Searches were conducted in fields covering title,

abstract, and keywords, ensuring that network externalities were central to the retrieved articles. Only journal articles published within the database coverage period (1994–2017) were considered. At the end of the identification stage, 67 records were retrieved.

Screening and eligibility: inclusion/exclusion criteria and selection process

All records were exported to a spreadsheet for reference management. First, duplicates were removed. Next, we performed a two-step screening process: (i) title and abstract screening, and; (ii) full-text eligibility assessment. To be included, studies had to: (a) be peer-reviewed journal articles; (b) address network externalities/network effects as a central construct; (c) examine technology adoption and/or diffusion as an empirical context; and (d) report empirical evidence (quantitative, qualitative, or mixed methods). Studies were excluded if network externalities were peripheral, if the context was not technology adoption/diffusion, or if the document type did not meet the inclusion criteria.

Important methodological clarification (addressing reviewer concerns): because this review draws on multiple databases with different journal evaluation systems, we did not apply journal-level impact metrics (e.g., JCR thresholds) as strict exclusion criteria. Instead, outlet indicators were treated as contextual information, while screening prioritized conceptual centrality, empirical relevance, and methodological transparency, consistent with contemporary SLR practices.

For each included article, we extracted standardized information: (i) technology context, (ii) research objective, (iii) theoretical lens, (iv) operationalization of network externalities, (v) main antecedents and consequences examined, and (vi) key findings. The synthesis followed an integrative qualitative approach: rather than summarizing articles individually, we grouped evidence by mechanisms, boundary conditions, and outcomes, and we used these categories to build an integrative framework. At the end of the process, the final corpus comprised 14 empirical articles, which were read in full and coded for framework construction.

Although the final corpus includes 14 studies, this number reflects the review's deliberately narrow scope, empirical work that explicitly examines network externalities in technology adoption/diffusion contexts, and stringent eligibility criteria. The goal

of this SLR is not statistical representativeness, but conceptual integration and framework development. Across the included studies, recurring mechanisms and outcomes indicated thematic saturation for the purposes of this analysis.

4 Results and discussion

This section presents (i) a descriptive overview of the publications retrieved and (ii) an integrative synthesis of the empirical evidence included in the qualitative review. From the initial search, 67 records were identified. Figure 2 depicts the temporal distribution of publications in this initial set. Rather than inferring causal explanations for peaks in specific years, we use this figure to indicate periods of higher scholarly attention to network externalities in technology-related contexts.

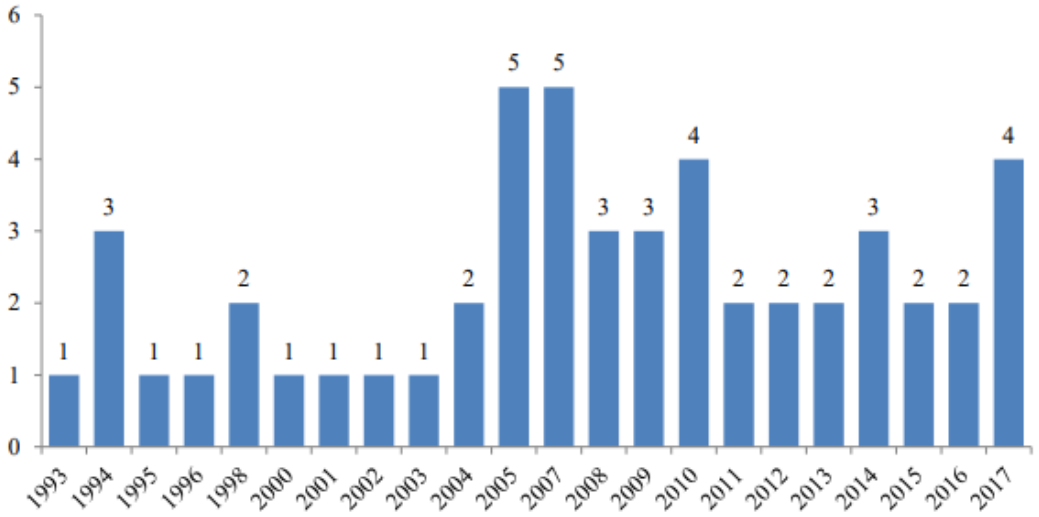

Figure 2: Temporal trends of publications
Source: Prepared by the author.

Although network externalities originated in economics, only a small share of the initially retrieved studies (67 records) were published in economics journals. The remaining publications were distributed across business administration, computer science, information systems, and marketing outlets. This pattern suggests that network externalities have become an interdisciplinary construct, widely adopted to explain technology adoption and diffusion phenomena in digital and platform-mediated environments, where individuals' perceptions and social influence mechanisms shape adoption decisions (Tucker, 2017).

After this descriptive overview, the following subsections synthesize the evidence from the eligible empirical studies included in the qualitative review (n = 14). The results are organized to: (a) describe the application contexts examined, (b) summarize the research objectives and theoretical lenses, (c) integrate the main findings around mechanisms, boundary conditions, antecedents, and consequences, and (d) consolidate a research agenda and an integrative framework.

4.1 Areas of application of the studies

To clarify how the debate on network externalities has been operationalized in empirical research on technology adoption and diffusion, this subsection synthesizes the main application contexts covered by the eligible studies. Overall, the literature concentrates on four recurring domains.

Communication, information systems, and ICT-related technologies. A significant portion of the reviewed studies examines network externalities in communication and information technologies, where interconnection and compatibility are central to value creation. In these contexts, network size, interoperability, and standards tend to shape adoption incentives and market structure (e.g., Heinrich, 2014; Dickinger, Arami and Meyer, 2008; Strader, Ramaswami and Houle, 2007).

Digital products, platform competition, and complementary ecosystems. Another group of studies focuses on digital products and platform-based competition, where indirect network externalities emerge through complements (e.g., devices, services, bundles, or complementary markets). These works analyze contexts such as computers/peripherals and service bundles, as well as platform rivalry and strategic interaction (e.g., Prasad et al., 2010; Halaburda et al., 2020). Related research also extends the analysis to technology distribution channels and channel competition, comparing online, traditional, and hybrid configurations where network effects and switching costs shape competitive outcomes (Li, 2005; Viswanathan, 2005).

Mobile and digital services with privacy/regulatory boundary conditions. More recent applications examine network externalities in mobile digital services where adoption is influenced not only by network size but also by contextual factors such as privacy assurance, perceived regulation, and complementarity. Mobile payment

applications exemplify this line of inquiry, in which network externalities interact with institutional and trust-related mechanisms that affect user behavior (Gong et al., 2019).

Organizational environments and internal social networks. A further stream investigates network externalities within organizations, emphasizing how adoption is shaped by internal communication patterns, leadership roles, and social influence. In this domain, technologies such as corporate communication tools and corporate blogs illustrate how network position and managerial participation can amplify diffusion dynamics (Tucker, 2008; Wattal et al., 2010).

Finally, some studies use consumer electronics markets to distinguish direct and indirect network externalities in early-stage diffusion settings. For example, research on digital music players and related complement markets illustrates how installed base and perceived availability of complements jointly shape adoption intentions in the early life cycle of technologies (Song et al., 2009).

4.2 The use of NE as a background for digital and information technology research

Rather than treating network externality as a standalone construct, the reviewed studies mobilize it as a theoretical background to address distinct but recurring research purposes in digital and information technology contexts. Overall, the literature employs network externalities to explain (i) individual behavior under uncertainty, (ii) strategic interaction among firms and platforms, (iii) coordination and information problems in networked markets, and (iv) technology adoption dynamics shaped by social influence and complements.

A first group of studies conceptualizes network externality as a boundary condition that shapes individual behavior in digital services and platforms. In this stream, network externality alters how users respond to privacy assurance, perceived regulation, and technology complementarity, influencing adoption-related behaviors such as self-disclosure and usage intentions (e.g., Gong et al., 2019).

A second research direction uses network externalities to examine strategic choices in technology markets, particularly pricing, bundling, and technology investment. These studies analyze how the intensity and symmetry of network externalities interact with cost structures to shape optimal firm strategies and competitive

outcomes in high-technology and platform-based markets (e.g., Prasad et al., 2010; Kim, Rhim and Yang, 2020).

Another set of contributions employs network externalities to explain coordination problems and information asymmetries in emerging industries and technology distribution channels. This literature highlights the role of focal points, leadership, common knowledge, and information transmission in coordinating diffusion processes under network externalities (Dew et al., 2007; Li, 2005), as well as how differences in channel flexibility and switching costs affect competition across online, traditional, and hybrid configurations (Viswanathan, 2005).

Network externalities are also integrated with technology adoption models and social influence theories, particularly extensions of the Technology Acceptance Model (TAM). In this stream, network size, feedback from others, and complement availability are shown to shape perceived usefulness, ease of use, enjoyment, and ultimately adoption and use decisions in organizational and consumer contexts (Strader, Ramaswami and Houle, 2007; Wattal et al., 2010; Dickinger et al., 2008; Song et al., 2009). Related studies emphasize that influential adopters and network position play a central role in diffusion dynamics (Tucker, 2008).

Finally, some studies extend the analysis to policy, standards, and structural conditions, showing how interoperability, regulation, learning orientation, and timing of entry interact with network externalities to influence industry structure, market stability, and firm success (Klimenko, 2009; Heinrich, 2014; Schilling, 2002). Under conditions of increasing connectivity and uncertainty, network externalities may also generate destabilizing effects on venture performance and survival (Podoynitsyna et al., 2013).

To provide a consolidated overview of the dominant research purposes addressed in the eligible studies, Table 3 summarizes the main topics organized by analytical category.

Table 3. Main research topics and purposes in the eligible studies

Analytical category	Author, year	Main research purpose / topic
Competitive strategy, pricing, bundling, and platform rivalry	Prasad et al. (2010)	Examine how symmetry/asymmetry in network externality intensity and marginal costs affects optimal bundling decisions.
	Viswanathan (2005)	Model competition across online, traditional, and hybrid channels; assess how network externalities, channel flexibility, and switching costs affect pricing and consumer outcomes.
	Halaburda et al. (2020)	Investigate whether a low-quality platform acting as market leader can sustain leadership under network effects.
	Kim, Rhim & Yang (2020)	Analyze how network externalities and cost differentials influence manufacturers' strategic choices and welfare implications in markets with competing technologies.
Coordination problems and diffusion dynamics in networked markets	Dew et al. (2007)	Identify coordination mechanisms (focal points, leadership, common knowledge) and timing issues that shape diffusion under network externalities.
	Shum et al. (2010)	Assess whether "induced diffusion" results from physical technology improvement or social-technology/policy innovation.
Channels, information, and trust in technology distribution	Li (2005)	Explain how information blockage and truth-telling/trust equilibria arise in technology distribution channels; examine how cheap talk may facilitate coordination.
Adoption models (TAM/TRA extensions), social influence, and organizational diffusion	Strader, Ramaswami & Houle (2007)	Investigate determinants of electronic communication systems use by extending TAM with network externalities.
	Wattal et al. (2010)	Examine whether network externalities influence social computing use in organizations; test moderation by age/gender and effects of feedback from others.
	Dickinger, Arami & Meyer (2008)	Extend TRA and TAM to incorporate hedonic motives in IT use and relate adoption drivers to network externalities.
	Tucker (2008)	Show how influential adopters (formal and informal network positions) affect others' adoption via social mechanisms in organizations.
Consumer adoption, complements, and installed base perceptions	Song et al. (2009)	Integrate network externalities with consumer perceptions of innovation attributes; assess how complements and installed base perceptions influence purchase intention.
Policy, standards, interoperability, and market structure	Klimenko (2009)	Discuss trade policy implications of standards and regulation ensuring technical compatibility/interoperability in markets with demand network externalities.
	Heinrich (2014)	Analyze interconnected network effects across sectors and their impact on industry structure, particularly in ICT.
Uncertainty and strategic flexibility under network externalities	Podoynitsyna et al. (2013)	Compare strategic responses (avoidance, imitation, control, cooperation, real options) to uncertainty in markets with network externalities; discuss destabilizing effects on venture performance.
Firm capabilities and timing of entry	Schilling (2002)	Show that beyond installed base and complements, learning orientation and timing of entry influence success in markets with network externalities.
Privacy/regulation and boundary conditions in digital services	Gong et al. (2019)	Examine how privacy assurance, network externality, and technology complementarity affect consumer self-disclosure in mobile payment applications; treat NE as a boundary condition.

Source: Prepared by the author.

Once the research purposes have been outlined, it is essential to synthesize the main contributions of the included studies. The next section integrates the empirical findings by highlighting the key results, underlying mechanisms, and implications associated with network externalities in technology-related contexts.

4.3 Network externality impacts on the digital and information technology

This subsection integrates the empirical findings of the reviewed studies by organizing the results around key mechanisms, boundary conditions, and consequences through which network externalities influence technology adoption, diffusion, and market outcomes. Importantly, the results reported here synthesize evidence from prior empirical studies and do not represent new empirical identification.

a) Strategic and competitive consequences of network externalities

A consistent finding across the literature is that network externalities significantly shape firm strategies and competitive dynamics in technology markets. When network externalities are strong and symmetric, strategies such as pure bundling become more effective, particularly under low marginal cost conditions. In contrast, asymmetric network externalities and cost structures lead to differentiated strategic responses, including aggressive pricing by inferior platforms and increased technology investment by superior platforms. These dynamics may stabilize or reinforce technology gaps depending on the cost of technological improvement, illustrating how network externalities link adoption expectations to competitive behavior.

However, empirical evidence also challenges the assumption that stronger network effects necessarily translate into higher firm profitability. In static markets, increased network externalities may primarily benefit consumers rather than firms, leading to lower prices and reduced profit extraction despite market tipping. This finding highlights that higher market share under network externalities does not automatically imply superior financial performance.

b) Coordination, communication, and common knowledge mechanisms

Beyond competition, network externalities influence diffusion through coordination and communication mechanisms. Empirical studies emphasize that adoption and diffusion in networked markets depend on the formation of common knowledge, leadership, and focal points that align expectations regarding timing, investment, and usage. Media and mass communication channels play a critical role in disseminating

shared understandings, making diffusion a fundamentally social process rather than a purely economic one.

Related evidence shows that communication strategies within distribution channels, such as credible signaling and information sharing, can facilitate coordination and demand formation under network externalities. At the same time, imperfect information transmission may reinforce erroneous beliefs and hinder efficient diffusion, underscoring the importance of trust and credibility in networked environments.

c) Social influence, network position, and organizational adoption

At the individual and organizational levels, network externalities operate through social influence mechanisms. Empirical findings indicate that adopters occupying central or influential positions within formal hierarchies or informal communication networks exert disproportionately strong effects on others' adoption decisions. Managerial participation and visible use of technologies amplify diffusion, even in systems initially characterized as bottom-up.

These results demonstrate that network externalities are not only a function of network size, but also of who adopts and how social influence is structured within networks.

d) Adoption outcomes, complements, and negative externalities

From the consumer perspective, network externalities positively affect adoption intentions through perceived usefulness, ease of use, enjoyment, and the perceived availability of complementary products. Installed base size and complement variety jointly reinforce adoption, supporting the notion of a virtuous cycle between network growth and perceived value.

At the same time, the literature documents important negative externalities. As networks expand, congestion effects—such as spam, unwanted interactions, and security concerns—may reduce perceived usefulness and deter continued adoption or diffusion of newer technologies. In this sense, network size can function both as an adoption driver and as a deterrent.

e) Standards, lock-in, and structural implications

Finally, several studies highlight the role of compatibility, standards, and lock-in mechanisms in shaping long-term market structures. Strong lock-ins and asymmetric control over compatibility may lead to monopolization tendencies and structural imbalances across industries. However, empirical evidence also suggests that learning orientation and timing of entry, in combination with installed base and complements, influence whether technologies are adopted, blocked, or displaced over time.

4.4 Network externality framework on based installed

Based on the included studies, the evidence suggests that technical compatibility/interoperability is a central enabling condition for network externalities in technology markets. When products and systems become more compatible, adoption frictions decrease and participation on both sides of the market may increase, expanding the installed base. As the installed base grows, network externalities tend to intensify, reinforcing adoption incentives and shaping market dynamics.

Figure 2 consolidates this logic into an integrative framework. The model links (i) installed base expansion to (ii) social diffusion mechanisms that accelerate adoption, labeled here as *virality,* and (iii) the resulting outcomes, which can be instrumental (functional/strategic) or negative (congestion and value-capture limitations).

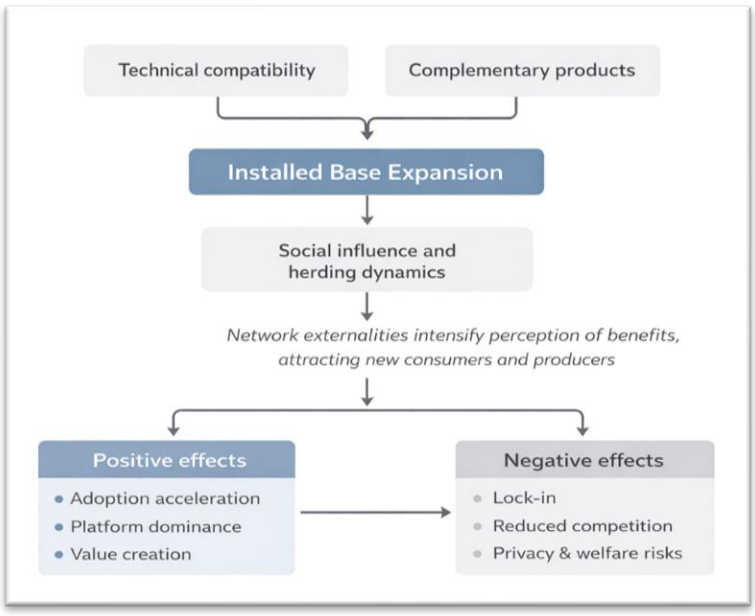

Figure 2: Installed-base-driven network externality framework: mechanisms and outcomes
Source: Prepared by the author
Note: The framework synthesizes evidence from the reviewed empirical studies, highlighting social amplification mechanisms and the dual (positive and negative) outcomes associated with network externalities.

Source: Prepared by the author

a) Diffusion mechanisms: "virality" as social amplification

Figure 2 highlights three social amplification mechanisms through which installed base growth can translate into faster diffusion. First, herd behavior captures situations in which adoption decisions are shaped by actors' expectations regarding the pace and extent of others' adoption. Under uncertainty, perceived momentum can strengthen the network and accelerate takeoff, but it may also amplify inaccurate beliefs when information transmission is distorted across channels.

Second, social influence emphasizes the role of network position: adopters in central roles, either in formal hierarchies or as boundary-spanners in informal communication networks, can disproportionately affect others' adoption decisions. This mechanism also reflects how interactivity and social contact increase perceived usefulness and experiential value, reinforcing adoption intentions.

Third, the bandwagon effect represents adoption driven by widespread visibility and shared "common knowledge" about the technology. Mass communication environments can accelerate diffusion by creating shared reference points, making coordination around a technology more likely.

b) Instrumental outcomes: strategic and functional implications

The framework also captures a set of instrumental outcomes associated with stronger network externalities. In two-sided and platform markets, increasing network externalities can intensify competitive dynamics: dominant platforms may invest more in technology improvement, while weaker platforms may respond through more aggressive pricing. As attention shifts from purely technical attributes to user-relevant value (e.g., usefulness and ease of use), installed base and favorable expectations can further reinforce dominance and adoption feedback loops. From a governance perspective, standards and regulation that ensure compatibility/interoperability may operate as institutional supports that enable network externalities and shape market structure over time.

c) Negative outcomes: congestion, lock-in, and limited profitability

Importantly, the reviewed studies also show that network externalities do not necessarily translate into superior profitability. In some contexts, particularly static markets, consumers may capture a larger share of the benefits from increased network externalities, while average prices and total profits may decrease. Moreover, network growth can generate negative externalities such as congestion and nuisance effects (e.g., spam and unwanted interactions), which reduce perceived usefulness and can impede adoption or the diffusion of newer technologies. In privacy-sensitive digital services, network externalities may also change how users respond to privacy assurance and regulation, highlighting that value creation through network growth can coexist with trust-related risks.

5 Conclusion and research agendas

Although network externalities have been extensively discussed in economics and business, prior research remains fragmented across disciplines and technology contexts. This study contributes by systematically synthesizing empirical evidence on network externalities in the adoption and diffusion of new technologies, consolidating dispersed findings into an integrative explanation of mechanisms and outcomes.

To achieve this goal, we conducted a systematic literature review using Web of Science, Scopus, and ScienceDirect, applying explicit inclusion and exclusion criteria. After screening and eligibility assessment, 14 empirical articles composed the final corpus. While modest in absolute terms, this final set represents the intersection of three restrictive conditions, (i) explicit focus on network externalities, (ii) empirical examination of adoption/diffusion in technology contexts, and (iii) quality/relevance filters, thereby ensuring a focused and analytically coherent basis for synthesis.

The review shows that network externalities research has evolved in an interdisciplinary manner, spanning business administration, marketing, information systems, and computer science, rather than remaining confined to economics. Technology objects range from hardware and digital products to platforms and organizational social technologies. Importantly, the evidence indicates that network externalities generate dual outcomes. On the one hand, they can accelerate adoption and diffusion via increasing perceived value, standardization, and complement availability; on the other, they may generate congestion, lock-in, privacy concerns, and limitations in value capture and profitability depending on market conditions. These insights are

consolidated in Figure 2 (Installed base–driven network externality framework: mechanisms and outcomes), which positions installed base expansion as a central driver, social amplification as a key mechanism, and positive and negative effects as coexisting outcomes.

5.1 Research agenda

Building on the integrated framework (Figure 2), future research can advance the field through the following streams:

(i) Network externalities under incompatibility and competing standards. A first research gap concerns markets in which incompatible technologies coexist, requiring users and firms to coordinate adoption under standard competition. Future studies should explicitly model competitive dynamics and feedback loops, particularly how network externalities interact with switching costs, expectations, and pricing strategies.

(ii) Market characteristic vs. business-model dependence on network effects. The review suggests the need to distinguish network externalities as a market characteristic from business models that are structurally dependent on network effects (e.g., multi-sided platforms and sharing economy models). This distinction can clarify when externalities are a contextual condition versus the central value-creation mechanism.

(iii) Organizational adoption: social structure, influence, and enterprise platforms. Organizational contexts remain a fertile but under-integrated setting for network externality research. Internal social technologies (corporate blogs, enterprise social networks, collaboration tools) allow researchers to observe how adoption depends on network position, hierarchy, boundary-spanning roles, and leadership signaling. How to study: social network analysis combining communication logs and adoption data; diffusion models identifying centrality effects; multilevel designs linking individual network position to organizational outcomes (knowledge sharing, coordination, productivity).

(iv) Relative network externalities and migration across technologies

As users migrate from one technology to another, externality benefits diminish for the incumbent and increase for the entrant, what can be conceptualized as

relative network externalities. This dynamic is essential for understanding technology succession and platform displacement.

(v) Beyond intention: practices, trust, and negative externalities. Finally, the corpus indicates that adoption cannot be explained only through intention-based models. Future research should incorporate actual user practices, interaction routines, and the emergence of negative externalities (congestion, spam, privacy and security concerns), which may weaken perceived usefulness and deter diffusion.

5.2 Practical implications

The framework (Figure 2) also suggests managerial implications: strategies aimed at accelerating adoption through installed base growth must be coupled with mechanisms that sustain perceived value (compatibility, complements, usability) while proactively mitigating negative externalities (privacy, congestion, lock-in risks). In this sense, managing network externalities is not only a growth challenge but also a governance challenge.

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