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Localized productive systems, knowledge transfer, technology transfer and innovation: a structured narrative review with a focus on Morocco

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ABSTRACT

Localized productive systems (LPS), industrial districts, clusters and regional innovation systems are territorial configurations in which proximity can facilitate the circulation of knowledge, technology transfer and innovation, without guaranteeing them. This review analyses the

mechanisms linking these configurations to innovation, with specific attention to Morocco. We conducted a structured narrative review with a systematized approach, combining a base of grey and open-access literature with searches in Scopus and PubMed; the two-stage selection is reported according to the applicable items of PRISMA-ScR, and the synthesis is thematic. Of 565 unique references, 308 were retained for in-depth assessment and 124 were included

(2001–2026), 20 of which explicitly concern Morocco. University–industry relations (38.7%) and absorptive capacity (29.8%) structure the corpus. Absorptive capacity is the most frequently documented mechanism (45.2% of references), ahead of social capital and trust (32.3%) and knowledge spillovers (27.4%). Geographical proximity acts mainly as an enabling condition: innovation depends on actors' capacity to absorb and recombine knowledge, on the complementarity between local networks and extra-local connections, and on the effectiveness of intermediaries. In Morocco, studies describe a consolidating system that remains constrained by post-patent valorisation, the coordination of interfaces and the absorptive capacity of SMEs. The findings argue for a territorial orchestration of transfer rather than a linear model, and for policies focused on capabilities rather than on the mere creation of clusters.

Keywords: localized productive systems; clusters; technology transfer; absorptive capacity; university–industry relations; Morocco.

1. Introduction

For several decades, the economic analysis of innovation has given growing importance to territory. In approaches based on localized productive systems (LPS), space is no longer regarded merely as a passive support for activities: it becomes a component of productive organization, learning and development. Courlet (2001) presents the LPS as a territorialized form of productive organization stemming, in particular, from work on industrial districts and characterized by a concentration of firms, reciprocal relationships and coordination mechanisms embedded in a territory. This reading extends the notion of the Marshallian industrial district (Becattini, 1990) and converges with the cluster approach popularized by Porter (1998).

This perspective is consistent with contemporary analyses of clusters and of regional or territorial innovation systems. Firms rarely innovate in isolation: they draw on relationships with suppliers, customers, competitors, universities, technical centres, public bodies, knowledge-intensive service providers and international partners. Networks thus act as channels of access to resources that exceed the firm's internal capabilities, notably knowledge, technologies, skills, data and sometimes financing (OECD, 2023).

The central issue is therefore not only whether geographical concentration fosters innovation, but how proximity becomes a mechanism for creating and diffusing knowledge. Work on knowledge flows in clusters distinguishes formal and informal exchanges, customer–supplier relationships, labour mobility,

imitation, R&D cooperation and access to external sources of technology. Basant (2002) emphasizes three sets of determinants: the internal characteristics of the cluster, its external linkages, and the economic and institutional environment. The proximity literature has further shown that geographical proximity is only one form of proximity among others (cognitive, organizational, social and institutional) and that it is neither necessary nor sufficient for interactive learning (Boschma, 2005).

Technology transfer is a more specific dimension of this circulation of knowledge. It may involve equipment, processes, intellectual property rights, technical skills, organizational practices or research results. Its success requires not only a source of technology but also the ability of receiving firms and institutions to identify, assimilate, transform and exploit the available knowledge. This logic refers to the notion of absorptive capacity (Cohen and Levinthal, 1990; Zahra and George, 2002), which has become central to explaining performance differences between firms or clusters exposed to comparable knowledge opportunities. Transposed to the cluster level, it refers to the collective capacity of a local system to capture, diffuse and exploit external knowledge (Giuliani, 2005).

In the Moroccan context, this question is particularly important. Successive industrial policies, clusters, sectoral ecosystems, university valorisation schemes and innovation infrastructures have progressively strengthened interactions between industry, research and institutions. Nevertheless, available institutional diagnoses still highlight constraints related to financing, coordination, the commercialization of scientific results, firms' absorptive capacity and the integration of local actors into higher-technology value chains (Cogneau et al., 2021; Jabri, 2024; OECD, 2024).

The objective of this narrative review is to analyse the relationships between localized productive systems, knowledge transfer, technology transfer and innovation, by identifying the main mechanisms, enabling factors, obstacles and implications for territorial innovation policies. The review relies on a systematized documentary approach (grey and open-access literature, structured searches in Scopus and PubMed, two-stage selection and standardized extraction) in order to produce a transparent and reproducible thematic synthesis.

Review question: to what extent, and through which mechanisms, do localized productive systems foster the transfer of knowledge and technologies and, ultimately, the innovation of firms and territories?

2. Methods

2.1. Review type and reporting framework

A structured narrative review with a systematized approach was chosen in order to integrate heterogeneous research traditions: territorial economics, economic geography of innovation, knowledge management, technology transfer and industrial policy. This choice is justified by the heterogeneity of designs and levels of analysis, which precludes any quantitative aggregation of effects. To ensure transparency, the approach combines a base of grey and open-access literature, reproducible searches in Scopus and PubMed, title/abstract screening followed by full-text assessment, and standardized extraction; the process is reported according to the applicable items of the PRISMA extension for scoping reviews (PRISMA-ScR; Tricco et al., 2018). No protocol was registered a priori. Selection and extraction were performed by two reviewers, independently and with cross-checking; disagreements were resolved through discussion among the authors.

2.2. Information sources

The initial search covered: (i) publications of international and national organizations; (ii) institutional repositories of universities and research bodies; (iii) open-access journal platforms; and (iv) public policy or diagnostic documents directly related to clusters, innovation systems or technology transfer. Specific attention was paid to Morocco in order to prepare a contextualized discussion. The main categories of sources are presented in Table 1.

Table 1. Categories of information sources used in the review.

Category	Examples of sources	Expected contribution
International institutions	OECD, European Commission/JRC, UNECA, ESCWA, UNIDO, WIPO	Innovation networks, cluster policies, technology transfer, innovation and productivity
Moroccan institutions	CNRST and associated institutional documents	National innovation system, research–industry interfaces, valorisation and transfer

OA academic repositories	Persée, IIMA Repository, SOAS Repository, university repositories	Foundational works and conceptual reviews
OA journals	Journal of Open Innovation, Innovation & Management Review, IMIST journals and other OA platforms	Empirical studies, knowledge and technology transfer mechanisms

2.3. Search strategy

The search was organized into conceptual blocks combined with Boolean operators. No strict time limit was applied, so as to retain foundational works, while recent institutional reports and empirical studies were prioritized to characterize current policies and dynamics. Queries Req-G/OA1 to Req-G/OA3 were applied to grey and open-access literature sources (Sections 2.3.1 and 2.3.2) and fed the initial documentary base of 30 references; queries Req-G/OA4 to Req-G/OA6 were adapted to the syntax of Scopus and PubMed (Section 2.3.3).

Req-G/OA1 – general query

("système productif localisé" OR "systèmes productifs locaux" OR cluster* OR "district industriel" OR "industrial district*" OR "localized productive system*" OR "regional innovation system*" OR "territorial innovation system*") AND ("transfert de connaissances" OR "transfert de savoir" OR "knowledge transfer" OR "knowledge spillover*" OR "technology transfer" OR "transfert de technologie") AND (innovation OR "innovation performance" OR "regional innovation")

Req-G/OA2 – knowledge flows

(cluster* OR "industrial district*" OR "localized productive system*") AND ("knowledge flow*" OR "knowledge transfer" OR "knowledge spillover*" OR learning) AND innovation

Req-G/OA3 – technology transfer

(cluster* OR "regional innovation system*" OR "industrial ecosystem*") AND ("technology transfer" OR "technology diffusion" OR "technology adoption") AND (SME* OR firm* OR industry)

Req-G/OA4 – absorptive capacity

(cluster* OR "industrial district*") AND ("absorptive capacity" OR "learning capability") AND (knowledge OR technology OR innovation)

Req-G/OA5 – university–industry

(cluster* OR "regional innovation ecosystem*") AND (university OR academia OR "research institution*") AND ("knowledge transfer" OR "technology transfer" OR commercialization)

Req-G/OA6 – Morocco

(Morocco OR Maroc) AND (cluster* OR "industrial ecosystem*" OR "système d'innovation") AND ("technology transfer" OR "knowledge transfer" OR innovation)

2.3.1. Execution of Req-G/OA2 – knowledge flows

Req-G/OA2 was carried out on 6 October 2026 through bilingual French/English searches of institutional directories, university repositories, open-access journals and publication pages of international organizations. Combinations associated cluster*, industrial district*, localized productive system*, knowledge flow*, knowledge transfer, knowledge spillover*, tacit knowledge, learning, proximity, local buzz, global pipelines, absorptive capacity and innovation. Complementary queries targeted Morocco/Maroc, university–industry, technology transfer and Industry 4.0.

Documents were included when an open-access full text or a substantial institutional version was available and the document made an explicit contribution to the mechanisms of knowledge circulation, their translation into innovation or the Moroccan case. Records without accessible full text, redundant content and purely promotional sources providing no analysis were excluded from this OA/grey corpus.

2.3.2. Execution of Req-G/OA3 – technology transfer

Req-G/OA3 was carried out on 6 October 2026 by combining the terms cluster*, industrial district*, regional innovation system*, science and technology park*, industrial ecosystem*, technology transfer, technology diffusion, technology adoption, licensing, university–industry, technology transfer office, innovation intermediary, absorptive capacity, foreign direct investment and global value chain*. Complementary searches targeted developing countries and Morocco. Sources included open-access journals, institutional repositories and publications of the

European Commission/JRC, UNECA and other international organizations.

Nine documents were added to the corpus when they provided directly usable results on transfer channels, the effectiveness of science parks and technology centres, university–industry collaborations, the role of intermediaries, global value chains or absorptive capacity. Publications without full access or without a specific contribution to transfer were kept outside the main corpus.

2.3.3. Structured searches in Scopus and PubMed – Req-G/OA4 to Req-G/OA6

Req-G/OA4 targeted absorptive capacity in clusters and industrial districts. In Scopus, the equation was run in a simplified operational form, "absorptive capacity" AND cluster in the title, abstract and keyword fields (TITLE-ABS-KEY), in order to favour sensitivity; it returned 223 documents. In PubMed, an equation adapted to the Title/Abstract fields returned 4 documents. Scopus pre-screening identified 29 records corresponding to 28 unique titles directly focused on absorptive capacity in a cluster or district context; PubMed yielded only one directly relevant document.

Req-G/OA5 explored university–industry relationships. A test query returned 1,153 documents in Scopus and a broad version 7,905 documents; the latter was discarded for extraction because of excessive noise. The targeted query Req-G/OA5b, combining university/industry, knowledge transfer or technology transfer, and cluster/district/regional innovation system, returned 235 documents. A first title/abstract screening identified 34 priority references.

Req-G/OA6 targeted Morocco by combining Morocco/Maroc/Moroccan with cluster, industrial ecosystem, regional innovation system and the terms innovation, knowledge transfer, technology transfer, absorptive capacity and university–industry. Scopus returned 34 documents: 13 were classified as directly relevant, 11 as secondarily relevant and 10 as probably off-topic at first screening. PubMed returned 47 documents, none directly relevant to the territorial and managerial focus of the review. A complementary exploratory PubMed query (cluster/innovation) returned 6 documents, which were included in the exports (Table 2). The Scopus and PubMed searches were run on 6 October 2026. Figure 1 summarizes the number of references identified in the main Scopus and PubMed exports.

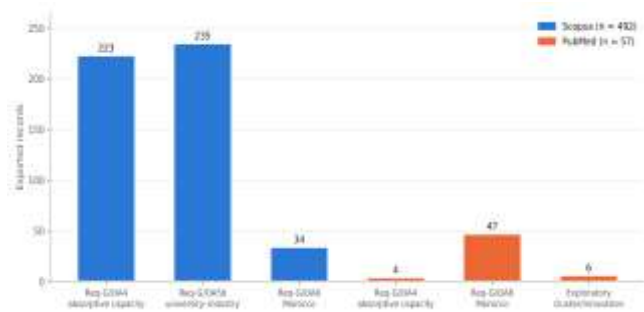


Figure 1. Number of references identified per exported query in Scopus and PubMed.

Table 2. Summary of structured searches in Scopus and PubMed and pre-screening.

Query	Database	Focus	Results	Exported	Decision / pre-screening
Req-G/OA4	Scopus	Absorptive capacity + cluster	223	223	29 records / 28 titles directly focused
Req-G/OA4	PubMed	Absorptive capacity + cluster/district	4	4	1 directly relevant
Req-G/OA5-test	Scopus	University–industry + transfer	1,153	–	Test; not exported
Req-G/OA5a	Scopus	University–industry + transfer/collaboration + innovation	7,905	–	Too broad; not retained for extraction
Req-G/OA5b	Scopus	University–industry + transfer + cluster/RIS	235	235	34 priority references
Req-G/OA6	Scopus	Morocco + cluster/ecosystem + innovation/transfer	34	34	13 direct; 11 secondary; 10 probable exclusions
Req-G/OA6	PubMed	Morocco + cluster/innovation/transfer	47	47	0 directly relevant
Exploratory	PubMed	Cluster + innovation	6	6	Integrated into overall screening

Scopus searches produced the largest volumes, particularly for absorptive capacity and university–industry relationships, whereas PubMed yielded a much more limited volume for this

territorial and managerial topic. Counts correspond to the exported results of the queries and are not additive, since the same publication may be retrieved by several search strategies.

2.3.4. Deduplication

The three Scopus exports comprised 492 records and the three PubMed exports 57 (Table 2), i.e. 549 records from the databases; together with the 30 references of the grey/OA literature base, 579 records were identified. Matching by DOI, normalized title and bibliographic metadata removed 12 duplicates between exports and 2 additional overlaps with the grey/OA base, leaving 565 unique candidates. Priority subsets are not additive because some publications appear in several queries.

2.3.5. Title/abstract screening and full-text assessment

Title/abstract screening covered the 565 unique candidates. In total, 257 references were excluded at this stage: 205 were out of scope with respect to the review question and 52 were false positives, notably due to the use of the term "cluster" in a statistical, biomedical or non-territorial sense. The 308 retained references were divided into two sets according to a thematic relevance ranking performed at the title/abstract stage, and not according to an arbitrary choice or to methodological quality. A reference was classified in the priority core when its title and/or abstract made it possible to identify a direct analytical relationship between three dimensions: (1) an explicit territorial anchoring (LPS, cluster, industrial district, regional innovation system, industrial ecosystem or other form of territorialized productive agglomeration); (2) a mechanism of circulation of knowledge or technologies (knowledge transfer, technology transfer, spillovers, learning, knowledge networks, absorptive capacity, university–industry relationships, intermediaries/gatekeepers); and (3) an innovation outcome or purpose (product, process or organizational innovation, innovation performance, technology adoption, upgrading, competitiveness or innovation-related territorial development). This ranking retained 142 references from the databases, which were added to the 30 references of the grey/OA base to form a priority core of 172 references; the remaining 136 references, relevant for framing the discussion but not combining these three dimensions, were classified as context literature. Only the priority core underwent full-text eligibility assessment: 124 references were included, 29 were reclassified as context literature, 3 were excluded after assessment and 16 could not be retrieved. The context pool thus comprises 165 references (136 + 29); these references may be cited to situate the findings but do not contribute to

any count. Figure 2 presents the distribution of decisions after title/abstract screening, and Table 2 summarizes the structured queries and their pre-screening.

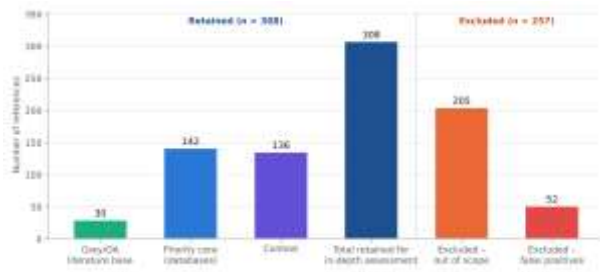


Figure 2. Decisions after title and abstract screening.

Title/abstract screening retained 308 references for in-depth assessment: 30 from the grey/OA base and 142 from the databases, forming the priority core (172), and 136 context references. The 257 exclusions comprise 205 out-of-scope references and 52 false positives, which underlines the importance of semantic screening after broad searches.

2.4. Eligibility criteria

Documents were included if they provided at least one substantial element on: (a) the definition and functioning of LPS, districts, clusters or regional innovation systems; (b) mechanisms of knowledge circulation; (c) technology transfer; (d) absorptive capacity or learning; (e) university–industry interfaces and the role of intermediaries; or (f) the Moroccan case. Promotional documents without analytical content, duplicates of institutional sources and texts whose access or provenance did not allow sufficient verification were excluded. No date restriction was applied. No language restriction was applied at the search stage; for extraction, full texts in French or English were prioritized, and publications in other languages were eligible when an abstract in French or English, together with verifiable metadata, allowed a sufficiently reliable extraction. For the grey/OA literature base, a full text was required. For references from the databases, a reference could be included on the basis of its abstract alone if its bibliographic identity was certain and the abstract made it possible to identify the territorial context, the transfer or innovation mechanism, elements of method or data and at least one interpretable result; no information absent from the abstract was extrapolated. References not meeting these conditions and whose full text could not be obtained were recorded as not retrieved ($n = 16$); they are not part of the 124 inclusions and do not contribute to the synthesis.

2.5. Data extraction and synthesis

For each included source, the following were recorded: the type of territorial system studied, the actors involved, knowledge transfer channels, technology transfer mechanisms, absorptive capacity factors, innovation outcomes, governance factors and, where relevant, implications for developing countries and Morocco. Extraction was harmonized across the 124 included references, whose complete list and extraction grid are provided in Table S1 (supplementary material). When the full text was available, extraction covered the complete document; otherwise, it relied on publisher/Scopus abstracts and detailed metadata (96 of 124 references, i.e. 77.4%; the remaining 28, from the initial sub-corpus, were extracted from a verified full text or open-access version). The synthesis is thematic and descriptive: the main axes are mutually exclusive, whereas the coding of mechanisms is non-exclusive and aims to build an explanatory model rather than to produce a quantitative effect estimate. The methodological quality of the studies was not formally appraised, in line with the mapping objective of the review; the design of each study is nevertheless coded and reported (Table 3 and Table S1) so that the weight of the evidence can be assessed. References from the context pool are cited to situate the findings.

2.6. Selection flow diagram

Figure 3 summarizes the whole process, from identification to inclusion.

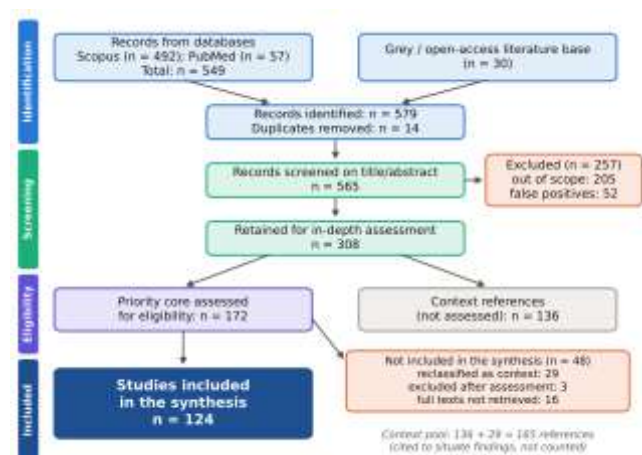


Figure 3. Flow diagram of reference selection.

Diagram adapted from PRISMA 2020 for a structured narrative review. The 16 full texts not retrieved were not excluded for scientific reasons and do not contribute to the synthesis. The context pool (165 references) is not included in any count.

3. Results

3.1. Characteristics of the included corpus

The 124 included references (Table S1) cover the period 2001–2026; 113 references (91.1%) have a DOI, 78 (62.9%) are flagged as open access and 20 (16.1%) explicitly include Morocco. Thematically, 48 references (38.7%) fall mainly under university–industry relations/valorisation, 37 (29.8%) under absorptive capacity, 19 (15.3%) under Morocco/innovation ecosystems, 10 (8.1%) under clusters and performance, 7 (5.6%) under knowledge networks, 2 (1.6%) under intermediation/gatekeepers and 1 (0.8%) under technology transfer as the main axis. Methodologically, 46 studies are quantitative, 21 qualitative or case studies, 13 conceptual/policy, 10 reviews or syntheses, 7 mixed-methods, 6 institutional/policy, 10 empirical with insufficiently specified methods, and 11 fall into other categories or remain partially documented.

Table 3. Summary characteristics of the included corpus (n = 124).

Dimension	Category	n (%)
Main axis	University–industry / valorisation	48 (38.7%)
Main axis	Absorptive capacity	37 (29.8%)
Main axis	Morocco / ecosystems and innovation	19 (15.3%)
Main axis	Clusters / innovation / performance	10 (8.1%)
Main axis	Transfer / knowledge networks	7 (5.6%)
Main axis	Intermediation / gatekeepers	2 (1.6%)
Main axis	Technology transfer	1 (0.8%)
Design	Quantitative	46 (37.1%)
Design	Qualitative / case study	21 (16.9%)
Design	Conceptual / policy	13 (10.5%)

Design	Review / synthesis	10 (8.1%)
Design	Mixed methods	7 (5.6%)
Design	Institutional / policy	6 (4.8%)
Design	Empirical – method not specified	10 (8.1%)
Design	Other / not specified	11 (8.9%)
Feature	References explicitly including Morocco	20 (16.1%)
Feature	References flagged as open access	78 (62.9%)
Feature	References with a DOI	113 (91.1%)
Chronology	Publications 2015–2026	90 (72.6%)

Main axes are mutually exclusive. Methodological categories result from harmonized coding of reported designs. The mechanisms presented in the text and in the following figures are non-exclusive: a single reference may document several mechanisms.

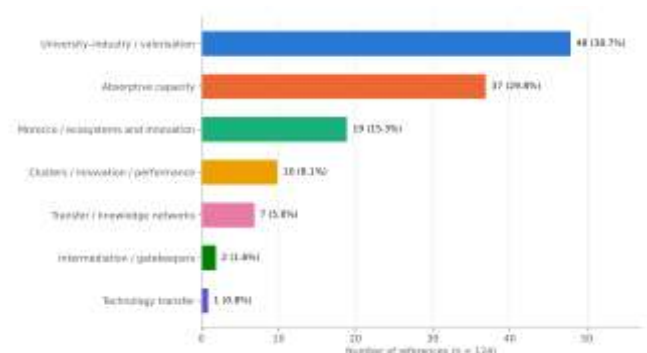


Figure 4. Distribution of the 124 references by main thematic axis.

University–industry relations/valorisation and absorptive capacity alone account for more than two thirds of the corpus. The Moroccan case also constitutes a substantial axis, whereas intermediation and technology transfer often appear as cross-cutting mechanisms rather than as the main focus of the articles.

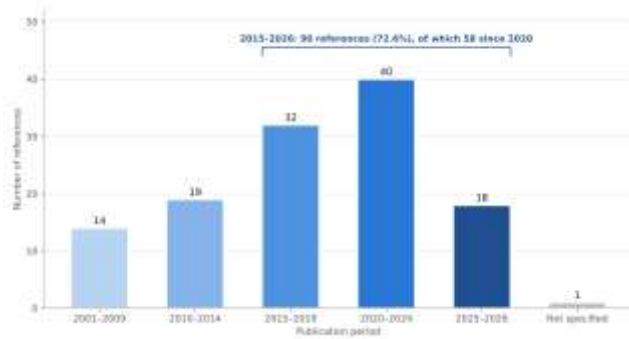


Figure 5. Temporal distribution of the 124 included references.

The literature intensifies markedly from 2015 onwards: 90 references (72.6%) were published between 2015 and 2026, of which 58 (46.8%) since 2020. This trend accompanies the shift of the debate towards regional innovation systems, open innovation, intermediaries, absorptive capacity and university ecosystems. Table 4 presents the structuring references of the included corpus used to organize the main axes of the narrative synthesis.

Table 4. Structuring references used for the narrative synthesis.

Reference	Type	Main contribution
Courlet, 2001	OA article – Persée	LPS, industrial district, territory as productive organization
Basant, 2002	OA working paper – IIMA	Knowledge flows, internal/external linkages and institutional environment
Asheim et al., 2011	Article / academic repository	Regional innovation systems, learning, cognitive boundaries
Amine, 2016	Article – web access	Cluster policy and territorial competitiveness in Morocco
Cooke, 2017	OA article	Articulation of territorial systems, global innovation networks and value chains
CNRST–ESCWA, 2017	Institutional report	Moroccan national innovation system and transfer structures

Cogneau et al., 2021	JRC/EU report	Diagnosis of the technology transfer landscape in Morocco
Fioravanti et al., 2023	OA article – CC BY	Knowledge transfer in technological innovation clusters
OECD, 2023	Institutional report	SME knowledge and innovation networks; role of clusters
Jabri, 2024	UNECA report	Technology transfer in Morocco: actors, sectors, challenges and recommendations
OECD, 2024	Institutional economic survey	Innovation, productivity, R&D and technology adoption in Morocco
WIPO, 2024	Institutional report	Development of TISCs and intellectual property/transfer capacities in Morocco
UNIDO, n.d.	Institutional resource	Inclusive and sustainable cluster development; multi-stakeholder collaboration
Weidenfeld et al., 2026	OA article	Dynamic conceptualization of regional systems as a continuum of knowledge networks
Bathelt et al., 2004	OA working paper – CBS	Local buzz, global pipelines and articulation of local and extra-local knowledge
Aarstad et al., 2016	OA article – Geoforum	Empirical test of local buzz/global pipelines; heterogeneity by firm size
Innocenti et al., 2020	OA article	Knowledge network structure, industrial variety and regional inventive capacity
Pagano et al., 2021	OA article – CC BY	Diffusion of Industry 4.0 knowledge in a traditional industrial district
Ben Dahmane Elidrissi, 2020	OA article – IMIST	Research–industry interface structures in Morocco and limits of valorisation

Bennani et al., 2025	OA article	Inter-firm linkages and technology transfer in Moroccan aeronautics
Chtioui & Boushib, 2026	OA article – Scientific African	FDI–technology transfer–human capital complementarity in Morocco; absorptive capacity
Hervás-Oliver et al., 2012	Article – OA repository	Technology centres, absorptive capacity and transfer in traditional clusters
Rigo, 2021	OA article	Global value chains, foreign technology licensing and transfer in 18 developing economies
Sala & Sobrero, 2021	OA article	Universities, laboratories, transfer centres and multi-level regional governance
Albahari et al., 2023	OA systematic review	Effects of science and technology parks on firm performance, innovation and cooperation
Sandoval Hamón et al., 2024	Systematic review	Science park–university relationships and the shift to open innovation ecosystems
Cohen et al., 2025	OA systematic review	Impacts of university–industry R&D collaborations and measurement difficulties
Yang et al., 2025	OA review	Twelve drivers and seventeen barriers of university–industry collaborative innovation
Hojnik et al., 2026	OA review	Determinants and indicators of university–industry knowledge and technology transfer
Soares et al., 2026	OA systematic review	Functions and mechanisms of innovation intermediaries in developing countries

3.2. From territory as proximity to territory as a knowledge architecture

The full corpus supports a relational reading of the LPS. Courlet (2001) and Asheim et al. (2011) provide the conceptual foundation: agglomeration is relevant only when accompanied by relationships, institutions and learning

mechanisms. Bathelt, Malmberg and Maskell (2004) refine this idea with the distinction between "local buzz" and "global pipelines". Cross-cutting coding of the corpus explicitly identifies local network/proximity mechanisms in at least 20 references and extra-cluster or global openness mechanisms in 18 references; 40 references also draw on social capital, trust or cooperation. These results confirm that the productive space functions as an architecture of relationships rather than as a simple concentration of firms.

Empirical studies confirm the heterogeneity of these mechanisms. Aarstad et al. (2016) show that regional and international collaborations are associated with innovation, without their combination being uniformly beneficial. Innocenti et al. (2020) highlight the joint importance of network structure and industrial variety. Studies in the corpus also show that network position, cluster development stage, firm size and the nature of the knowledge base modify the benefits of proximity (Giuliani and Bell, 2005; Martínez-Cháfer et al., 2018; Woods et al., 2022; Son et al., 2024). The common finding is that a high-performing cluster is characterized by the diversity, centrality, openness and quality of the relationships that organize knowledge circulation.

3.3. Absorptive capacity, the most documented mechanism between transfer and innovation

Absorptive capacity is the most frequently documented cross-cutting mechanism: it is explicitly identified in 56 of the 124 references (45.2%). At the level of the local system, Giuliani (2005) shows that cluster growth depends on firms' capacity to absorb external knowledge and then diffuse it locally. Hervás-Oliver et al. (2012), in a low-tech manufacturing cluster of 80 firms, show that access to technology centres depends on internal knowledge and skills; Chandrashekar and Hillemane (2018) link absorptive capacity to intra- and extra-cluster ties and then to innovation performance; Molina-Morales et al. (2021) extend this mechanism to radical innovation in industrial districts. The broader corpus confirms that absorptive capacity also operates in open innovation networks, university–industry collaborations, value chains and regional systems.

The findings call for moving beyond a strictly internal conception of absorptive capacity. Munari et al. (2012) show that certain focal firms capture more external knowledge and take part in its local diffusion. Expósito-Langa et al. (2015) highlight the role of a shared vision in articulating internal resources and networks, while Karlsen et al. (2023) show how intermediaries strengthen collective absorptive capacity. The synthesis of the 124 references therefore leads to distinguishing three complementary levels: the capacity of the

firm, the capacity of the network to distribute knowledge and the territorial capacity to organize access to external sources.

3.4. Gatekeepers, intermediaries and the governance of transfer

Transfer does not follow a linear path from a knowledge producer to a user. Twenty-three references explicitly document intermediation, gatekeeping or brokerage functions. In a Chilean wine cluster, Giuliani and Bell (2005) show that knowledge circulates mainly within a core of firms with high absorptive capacity, some of which play an active gatekeeper role. The technological gatekeepers described by Munari et al. (2012), the technology centres studied by Hervás-Oliver et al. (2012), the cluster intermediaries analysed by Karlsen et al. (2023) and the university technology transfer organizations studied by Kreiling et al. (2020) perform complementary functions: monitoring, selection, translation, brokerage, integration, orchestration, maturation and redistribution of knowledge.

The consequence is important for LPS governance: the existence of an interface structure is not enough. Its effectiveness depends on its capacity to understand firms' needs, connect distant cognitive communities, reduce information asymmetries and support project maturation. Cross-cutting coding also identifies 29 references focused on technology transfer or commercialization and 24 on policies, institutions or public support. Intermediaries should therefore be assessed on transfer and learning outcomes (partnerships, technology adoption, skills upgrading, commercialized innovations) and not merely on their institutional presence.

3.5. University–industry relations: a multichannel and reciprocal transfer

University–industry relations are the main thematic axis of 48 references (38.7%), making them the largest group in the corpus. The survey by Fernández-Esquinas et al. (2016), covering 737 innovative firms in Andalusia, shows that interactions are structured around several dimensions: knowledge generation and adaptation, training, human resource mobility, intellectual property and access to equipment. Muscio et al. (2012) show that the proximity of universities to industrial districts facilitates collaboration, but the full corpus confirms that proximity is not enough: firm capabilities, interface organizations, partnership quality and institutional embeddedness determine the effective use of knowledge.

Dell'Anno and del Giudice (2015) emphasize the absorptive and desorptive capacities of actors, while Kreiling et al. (2020)

show that university technology transfer organizations simultaneously adopt several roles depending on the stakeholders of the regional system. Recent reviews of university–industry collaboration reinforce this multichannel reading (Albats et al., 2022; Pujotomo et al., 2023; Cohen et al., 2025; Yang et al., 2025; Hojnik et al., 2026). The findings thus converge towards a reciprocal conception of transfer: collaborative research, consulting, training, mobility, technological services, patents/licences, spin-off creation and informal relationships are complementary and should be assessed as a portfolio rather than as isolated channels. This conception is consistent with the triple helix model, in which interaction between university, industry and government drives innovation systems (Etzkowitz and Leydesdorff, 2000).

3.6. Extra-local openness, value chains and digital instruments

The full corpus confirms the complementarity between local embeddedness and openness. Extra-cluster connections, internationalization and global pipelines are explicitly documented in at least 18 references; they bring new knowledge, reduce the risk of cognitive lock-in and connect clusters to value chains and research networks. Rigo (2021) shows, for developing countries, that the effects of value-chain participation on technology transfer depend on complementary local capabilities. Studies on the diffusion of Industry 4.0 knowledge in industrial districts (Pagano et al., 2021) and on the digital transformation of manufacturing clusters (Xue and Hu, 2026) similarly show that technologies only have an effect when embedded in learning and intermediation arrangements.

Digital tools and artificial intelligence remain an emerging theme rather than a dominant mechanism in the corpus: only a few studies explicitly place them at the centre of transfer (Xue and Hu, 2026; Xia et al., 2026). Across 31 Chinese provinces, Xia et al. (2026) thus observe that absorptive capacity plays a more decisive role than AI in the effectiveness of knowledge transfer and exploitation. The contribution of digital tools appears mainly instrumental (networking, monitoring, service automation or data exploitation), whereas human and organizational capabilities remain decisive. Digital transformation therefore replaces neither absorptive capacity, nor trust, nor interface structures; it can strengthen them when integrated into an already functional relational architecture.

3.7. The Moroccan corpus: from cluster creation to transfer capacity

Morocco is a particularly instructive case: 20 included references explicitly concern the country, 19 of which are classified under the Morocco/innovation ecosystems axis and one under the clusters/performance axis. The corpus describes a consolidating system, with visible achievements in cluster policies, aeronautics, intellectual property schemes, the structuring of universities and the emergence of ecosystems such as Casablanca Finance City (Oumaima and Massou, 2024). The institutional diagnoses of Cogneau et al. (2021), UNECA (Jabri, 2024) and the OECD (2024) nevertheless converge on constraints of coordination, commercialization, territorial diffusion and absorptive capacity. This trajectory is part of a long-term evolution of state–industry relations and upgrading strategies (Cammett, 2007), while recent work on Moroccan clusters highlights the role of social capital, trust and network density (Mamad et al., 2024), as well as cognitive proximity and effective governance in converting interactions into innovation performance (Lachgar et al., 2026).

Empirical studies specify these constraints. Hamdani and Bendou (2019) analyse modes of technology transfer in the industrial ecosystems of Souss-Massa; Nassiki and Ahrouch (2020) show that inter-firm and industry–science cooperation mediates the effect of clusters on innovation performance; Jamai et al. (2022) identify distinct profiles of firm readiness for collaborative innovative projects; Galiulina and Touate (2022) highlight the role of culture in managing open innovation projects within clusters, a complementary study by the same authors emphasizing communication (Galiulina and Touate, 2023); Hamidi and Berrado (2024) propose an international benchmarking framework (Morocco, Turkey, Spain) to identify levers for improving the national innovation system; Yassine et al. (2024, 2025) document both the obstacles to patent valorisation and the need to standardize university processes for monitoring, maturation and transfer. In aeronautics, Khamlach et al. (2019) relate ecosystem maturity to actor density, FDI and the progressive integration of more complex activities, while Bennani et al. (2025) emphasize that technological spillovers depend on the quality of inter-firm linkages. Work on Casablanca Finance City (Oumaima and Massou, 2024) completes this picture by emphasizing knowledge sharing, collaborative skills and trust.

Taken together, these studies shift the question from the formal existence of clusters to their capacity to transform interactions into learning and innovation. Five needs emerge: strengthening the absorptive capacity of SMEs, professionalizing research–industry interfaces, financing post-patent maturation, deepening technological linkages with

value chains and improving coordination between universities, firms, TISCs/TTOs, clusters and public institutions.

3.8. Integrated model derived from the included corpus

The full synthesis supports a conditional-chain model rather than a linear one: LPS/cluster → proximities and networks → access to local and external knowledge → absorptive capacity + intermediation → transfer, recombination and commercialization → innovation, upgrading and territorial performance. This chain is moderated by human capital, in-house R&D, trust, governance, university–industry links, intellectual property, public policies, global value chains and, more recently, digital tools. The corpus thus shows that innovation results from a territorial orchestration of resources, capabilities and relationships, and not from the automatic consequence of co-location (Figure 6).

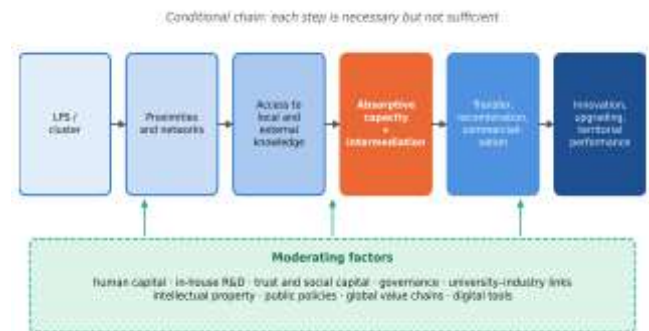


Figure 6. Integrated model of knowledge transfer in localized productive systems derived from the synthesis.

4. Discussion

4.1. Proximity is an enabling condition, not a guarantee of innovation

The first cross-cutting lesson is the distinction between proximity and effective transfer. Proximity reduces certain coordination costs and facilitates access to tacit knowledge, but it guarantees neither its diffusion nor its use. The full corpus shows that territorial benefits depend on the quality of relationships, cognitive diversity, the position of actors in networks and their capacity to process accessible knowledge. A cluster policy limited to geographical concentration therefore risks producing agglomeration without a genuine learning system. This finding converges with Boschma's (2005) analysis: too little proximity limits learning, but excessive proximity exposes actors to cognitive lock-in. It is also consistent with recent systematic reviews, which describe heterogeneous effects of science and technology parks on the

innovation of tenant firms (Albahari et al., 2023) and stress the difficulty of measuring the impacts of university–industry collaborations (Cohen et al., 2025).

4.2. Absorptive capacity links the micro, meso and territorial levels

The second contribution is the multi-level reading of absorptive capacity, a mechanism explicitly present in 56 references. At firm level, it rests on prior knowledge, human capital, learning routines and R&D effort (Cohen and Levinthal, 1990; Zahra and George, 2002). At network level, it depends on the presence of gatekeepers, brokers and cognitively complementary partners (Giuliani, 2005; Giuliani and Bell, 2005). At territorial level, universities, technical centres, cluster organizations and public policies condition access to external knowledge and its diffusion. This reading explains why firms exposed to the same cluster environment obtain different benefits.

4.3. From linear transfer to territorial orchestration

The corpus leads to abandoning a linear representation of technology transfer. Twenty-three references explicitly document intermediaries/gatekeepers and 29 technology transfer or commercialization mechanisms. Transfer is built through iterations: formulation of needs, search for partners, translation of knowledge, testing, maturation, adaptation of routines and reciprocal learning. This logic justifies assessing ecosystems by the quality of orchestration processes, and not only by the number of patents, licences or structures created.

4.4. Balancing local embeddedness and global openness

The fourth lesson is the need for a balance between local embeddedness and openness. Local buzz facilitates contextualized learning, while global pipelines, value chains and international collaborations renew the knowledge stock. However, openness has an organizational cost and may exceed the processing capacities of SMEs. The challenge is therefore not to maximize connections, but to build a coherent combination of local density, partner diversity and absorptive capacity.

4.5. Implications for Morocco: from cluster policy to capability policy

For Morocco, the 20 dedicated or comparative references suggest a shift in the objective of public policies: it is no longer only a matter of creating clusters, ecosystems or infrastructures, but of strengthening the capabilities that enable these schemes to produce learning. Five priorities emerge: (1) consolidating the technical and managerial skills

of SMEs; (2) professionalizing interface and transfer structures; (3) supporting the maturation and commercialization of research results; (4) deepening linkages between multinationals, universities and local suppliers in order to increase the technological content of exchanges; and (5) improving territorial and inter-institutional coordination.

Performance measurement should follow this logic. Beyond the number of firms, patents or infrastructures, indicators of relational depth would be more informative: collaborative R&D projects, technical assistance, engineer mobility, co-development, access to platforms, maturation, supplier upgrading, commercialized innovations and inter-regional diffusion. Such an approach would make it possible to assess whether the ecosystem effectively transforms investments and interactions into lasting local technological capabilities.

4.6. Heterogeneity of effects and the place of SMEs

SMEs appear particularly sensitive to heterogeneity in capabilities. Their size, R&D resources, collaboration experience and human capital sometimes limit the value they can draw from available networks and infrastructures (Fulgence et al., 2023; Son et al., 2024). Several studies in the corpus also show that benefits are concentrated among actors that are already central or better equipped to absorb knowledge (Giuliani and Bell, 2005; Munari et al., 2012; Martínez-Cháfer et al., 2018; Woods et al., 2022). Cluster policies should therefore include translation, training, pooling and support functions in order to avoid a polarization of benefits.

4.7. Limitations

Several limitations should be noted. First, the documentary level of extraction is not homogeneous: part of the studies was extracted from full texts, but the majority (96 of 124, i.e. 77.4%) from publisher/Scopus abstracts and metadata only, without extrapolation beyond their content; the results should therefore be interpreted as a structured narrative synthesis of the available corpus. Second, the structured search was limited to Scopus and PubMed; the absence of Web of Science, EconLit and Cairn may have reduced coverage of the economic and French-language literature on LPS, which the grey and open-access literature base only partially compensates. Third, only the priority core of 172 references was assessed in full text; the 136 context references, which did not combine the three required dimensions at the title/abstract stage, were not subjected to this assessment, so that relevant studies whose abstracts imperfectly described these dimensions may have been missed. Fourth, the thematic distribution partly reflects the search strategy: dedicated

queries on absorptive capacity and university–industry relations mechanically increased the weight of these axes, so that the predominance of absorptive capacity should be read as a regularity of the corpus rather than as a measure of its relative importance in the literature. Fifth, the methodological quality of the studies was not formally appraised, and the non-exclusive categories of mechanisms rest on thematic coding that does not allow effect sizes to be estimated. Finally, sixteen full texts could not be retrieved, and the heterogeneity of sectors, territories, designs and levels of analysis limits any causal generalization, while making it possible to identify cross-cutting regularities across contexts.

5. Conclusion

The synthesis of the 124 included references converges towards a central conclusion: a localized productive system becomes innovative less through mere geographical proximity than through its capacity to organize the circulation, absorption, translation and recombination of knowledge. Absorptive capacity appears as the most documented cross-cutting mechanism of the corpus, while local networks, extra-local connections, social capital, gatekeepers, intermediaries, universities and technology centres form a transfer architecture whose effectiveness depends on the internal capabilities of actors and on territorial governance.

For Morocco, the 20 references explicitly including the country describe a consolidating system: cluster policies, aeronautics, intellectual property schemes, Fintech ecosystems and the structuring of university innovation have created new capabilities, but their effect remains conditioned by SME readiness, the quality of cooperation, the performance of interface structures, the financing of maturation and technological integration into value chains. The main challenge is therefore no longer only to connect actors, but to increase their capacity to learn from one another and to transform knowledge into innovations, commercialization and upgrading.

Author contributions

Khawla Jabari: conceptualization, methodology, investigation, data curation, formal analysis, writing – original draft, writing – review and editing. **Anas El Anssari:** conceptualization, methodology, investigation, data curation, formal analysis, writing – original draft, writing – review and editing. **Aida Soulaymani:** conceptualization, methodology, investigation, data curation, formal analysis, writing – original draft, writing – review and editing. The three authors contributed equally to this work and approved the final version of the manuscript.

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Conflicts of interest

The authors declare no conflict of interest related to this work.

Data availability

The list of the 124 included references and the standardized extraction grid are provided as supplementary material (Table S1). Bibliographic exports and selection files are available from the authors upon reasonable request.

Use of artificial intelligence tools

Generative artificial intelligence tools were used to improve the presentation of figures, check calculations and improve the writing style. They were not used for reference selection, data extraction or interpretation of results. The authors verified all content concerned and take full responsibility for the manuscript.

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