

Examining the Connections between Knowledge Dynamics, Customer Knowledge Management, and Open Innovation: A Bibliometric Analysis

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Abstract

In the current dynamic context companies are forced to explore all the necessary ways to determine new solutions of adaptation and innovation to the needs and requirements of the market. This paper seeks to delineate the connections and potential media effect existing between knowledge dynamics, customer knowledge management and open innovation offering new perspectives for organizations to develop open innovation processes. Subsequently, the paper interprets and explores these connections through a bibliometric analysis using VOSviewer and a critical interpretation of the semantic links between main concepts. This study fills a significant gap in the literature by exploring the link between these fundamental concepts, and introducing the concept of knowledge dynamics. It should be emphasized that the present study is limited to qualitative data analysis, which requires further exploration and validation of the empirical study through future quantitative investigations.

Keywords: *knowledge management, knowledge dynamics, customer knowledge management, open innovation, customer, dynamic capabilities, co-creation, knowledge exchange.*

JEL classification: C81, D01, D21, D83

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1. Introduction

In today's rapidly evolving business landscape, organizations face the imperative to harness the power of knowledge and innovation to stay competitive. The intricate interplay between Customer Knowledge Management (CKM), Knowledge Management (KM), Knowledge Dynamics (KD), and Open Innovation (OI) has become a focal point for companies seeking to navigate the complexities of the modern marketplace. Understanding the nuances of these key concepts is essential for organizations aspiring to create a sustainable and resilient business ecosystem.

CKM became a strategic approach that recognizes the invaluable insights embedded in customer interactions. By leveraging CKM, businesses aim to systematically capture, organize, and apply customer knowledge to enhance

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products, services, and overall customer experiences. The effective integration of CKM allows organizations to stay attuned to customer preferences, adapt swiftly to changing demands, and foster long-term relationships (Gebert et al., 2003; Gibbert et al., 2002). KD, on the other hand, represents the fluid and adaptive nature of information within an organization. As knowledge evolves, organizations must manage tacit or explicit knowledge and facilitate KD (rational, emotional, and spiritual knowledge) inside and outside the organization. KD involves creating, sharing, and utilizing knowledge across employees, customers, or departments, enabling an agile response to market trends and internal developments. A keen understanding and use of KD is crucial for organizations striving to optimize internal processes and foster a culture of continuous learning (Bratianu, 2023; Bratianu & Bejinaru, 2023).

OI has emerged as a transformative paradigm regarding the concept of innovation. Beyond traditional closed innovation models, OI collaborates with external stakeholders, including customers, suppliers, and competitors, to co-create value. By embracing OI, organizations tap into diverse perspectives, external expertise, and new ideas, accelerating innovation and enhancing their competitive edge (Chesbrough, 2006; Dandonoli, 2013). However, open innovation may induce some knowledge risks (Bratianu et al., 2020).

The literature review concludes that external knowledge and customers are the foremost common subjects regarding the three concepts. To understand the potential and influence effects between CKM, KD, and OI, we turn to the analytical tool VOSviewer (Van Eck & Waltman, 2021). VOSviewer is a software that allows the construction and visualization of bibliometric networks, offering a unique perspective through which we can explore academic exposure and the existing connections between these concepts. The primary purpose of this analysis is to discover the key research themes and delimit the possible media effect of KD in the CKM and OI processes, offering a perspective on the impact of these relationships on the development and achievement of organizational success. The present study aims to answer the following research questions:

Q1: Are knowledge dynamics an enabler of open innovation processes?

Q2: What are the bibliometric connections between knowledge dynamics, customer knowledge management, and open innovation?

The research paper was structured as follows to provide answers to the present questions. In the literature review, the essential ideas that lead the research will be outlined, the concepts defined and highlighted, and the links between concepts found in the literature highlighted. The second part will analyze the methodology used to collect, refine, analyze, and interpret the data. The last part will draw the research conclusions, highlighting the limitations and new research directions.

2. Literature review

Knowledge is currently a critical resource for adapting to the changing demands of society, purchasing power, and consumer demands (Cohen & Levinthal, 1990; Davenport & Prusak, 2000; Nonaka & Takeuchi, 1995). Also, it is

a key tool in understanding buying behavior. Companies need to expand their knowledge from the internal environment to the external to stimulate innovation processes. Understanding this phenomenon, followed by incorporating external knowledge into innovation processes, has generated a shift in the innovation paradigm, bringing to the attention the concept of OI (Chesbrough, 2006). This approach involves integrating external knowledge from competitors, consumers, investors, or other stakeholders throughout the innovation process. This allows companies to develop shorter innovation cycles, optimize costs, increase performance, increase customer satisfaction, and develop new competitive advantages, thus overcoming the resource gap that may arise (Agapie et al., 2018; Piller et al., 2004).

Knowledge is an element of abstraction based on metaphoric thinking (Bratianu, 2022). The attributes of knowledge derive from their anchoring in notions already known to the field of origin, then shaped by individuals' experiences, expertise, values, and beliefs. Their transmission, understanding, and use vary depending on the field of knowledge of each individual (Davenport & Prusak, 2000). The development of the KD concept emphasizes the transmission of knowledge through the four quadrants represented by the SECI model (Socialization, Externalization, Combination, Internalization), which describes the dynamics of knowledge as a stream of tacit and explicit knowledge that facilitates the generation, transfer, and application of knowledge (Nonaka et al., 2009; Nonaka & Takeuchi, 1995) as well as, complementarily, the thermodynamics model of Bratianu, which identifies areas of emotional knowledge (EK), rational knowledge (RK) and spiritual knowledge (SK) (Bratianu, 2022; Bratianu & Bejinaru, 2023). KD involves the transformation and variation of knowledge in time and space (Bratianu, 2023), allowing their integration into the organization's knowledge capital.

Studies that analyze the potential links between KD and OI are quite limited; they focus mainly on transferring knowledge from consumers to the organization, capturing and using them within the organization; the knowledge exchange especially accompanies knowledge transfer. Here, we identify the main common element highlighted in the relationship between the two concepts, consumer and consumer knowledge. To facilitate OI processes, an active knowledge exchange between the consumer and the organization should be developed based on a trust transfer. This fact automatically involves the application of KD in external communication. Moreover, this exchange of knowledge that involves a voluntary and deliberate activity is susceptible to more frequent transmission of knowledge of a tacit nature and EK and SK, which allows a greater degree of innovation in the company (Bratianu, 2023; Bratianu et al., 2021).

A facilitator and catalyst of IO processes are recognized in the literature as CKM. By definition, the two concepts are complementary, and practice highlights this. CKM processes involve an ecosystem of interactions between organizations and consumers, ecosystems that benefit from the mutual transfer of knowledge and the development of a monthly relationship with the consumer, turning them into

business partners and co-creators of the products and services they benefit from. (Sofianti et al., 2010). Customer knowledge is characterized as the integration of customer values, experience, and perception resulting from the interactions between the firm and its customers (Gebert et al., 2003), so they involve all three fields of knowledge RK, EK, and SK. CKM is defined by three key dimensions of knowledge: knowledge about clients, knowledge about customers, and knowledge from customers (Gebert et al., 2003). Each of them has a distinct relevance and importance in the customer relationship process as well as in the OI processes (Zhang, 2011). The correlation between OI and CKM is significantly influenced by organizational competitiveness and performance as well as by the ability of the internal environment to absorb and use knowledge. Technological development increasingly facilitates relationships based on the exchange of RK, EK, and SK.

Therefore, in interpreting the mediation relationship between the three key concepts, we can divide CKM into two essential purposes: the first represents the development of a relationship system between the organization and consumers based on trust that facilitates the exchange of mutual information on various channels (Nguyen et al., 2021; Oumlil el al., 2020). This action involves applying KD to the communication level. The second purpose is to facilitate the acquisition, integration, and utilization of knowledge about customers, from customers and for customers to be filtered and introduced into the intellectual capital of the organization. Consequently, OI is closely linked to the CKM field, and the correct correlation of the two processes significantly influences organizational competitiveness and performance (Nguyen et al., 2021; Oumlil et al., 2020).

Thus, we can argue that applying KD to the level of external communication causes a constant flow of knowledge exchange between organizations and their external environments, which enables the development of OI processes. OI leverages external knowledge through CKM processes, which allow capturing, filtering, and selecting usable knowledge from consumers, for consumers, and about consumers to develop holistic and collaborative OI processes.

3. Methodology

The present paper is based on a systematic and comprehensive methodology that has guided data collection, refinement, and analysis to answer the research questions mentioned earlier. The first stage involves collecting data relevant to the research, representing a comprehensive element of the three concepts subject to research. The second stage involves meticulous refinement of data to build a database relevant to bibliometric analysis. The third phase involved using the WOSviewer software to visualize the connections between terms and major trends explored in the academic world. This methodological approach has made it possible to highlight an overview of the present media concepts and effects. Using the "keyword" search criteria, no publication included all three concepts as keywords until March 2024, when the research was carried out.

Therefore, Table 1 explains the search criteria and the combination of constructs chosen to constitute the basis included in the bibliometric analysis

Research protocol and characteristics and types

Table 1

Search Criteria	Analyses
Search expressions	CKM AND OI; KD AND CKM; KD AND OI
Search database	Web of Science & Scopus
Search Within	Keywords
Search fields	All fields;
Type of publications	All types of publications indexed
Subject Areas	All subject areas included
Timespan	2000 - January 2024
Language	English
Techniques for the Bibliometric Study	Research field charting
Software for bibliometric research	VOSviewer

Using the present criteria, we can identify relationships and compile a comprehensive database to conduct a bibliometric analysis that reflects all three concepts. Choosing the “keyword” search criterion allows for exploring the complex connections between concepts and improving their interpretation. The chosen search criteria allow a balance between data extraction and a combination of extracted databases. Data is collected systematically from SCOPUS and Web of Science (WoS), following predefined criteria. After refining and removing duplicates, 67 works that meet the search requirements were included in the bibliometric analysis. To provide support and consistency to the analysis, the resulting data were interpreted from the perspective of existing literature, and the main connections identified at the conceptual level between the key concepts were traced. The perspectives highlighted can be the subject of quantitative research to test and validate the findings of this study.

4. Results and discussions

To present a conceptual relationship as truthful as possible between KD, CKM, and OI, all the keywords highlighted by the author and the indexed keyword were analyzed. Based on this criterion, the software identified 645 keywords. By setting a minimum number of appearances of 4, the software identified 34 keywords subject to analysis. The articles recorded a total of 264 links and had a total link power of 559. The articles were included in four groups. While the bibliometric analysis software determined the cluster, the distribution of terms, and coloristic highlighting, cluster labels were chosen by the authors by emphasizing the term that had the most occurrences for each cluster. Cluster 1 – dynamic

capabilities; Cluster 2 - Customer Satisfaction; Cluster 3 - knowledge management; Cluster 3 – Open Innovation.

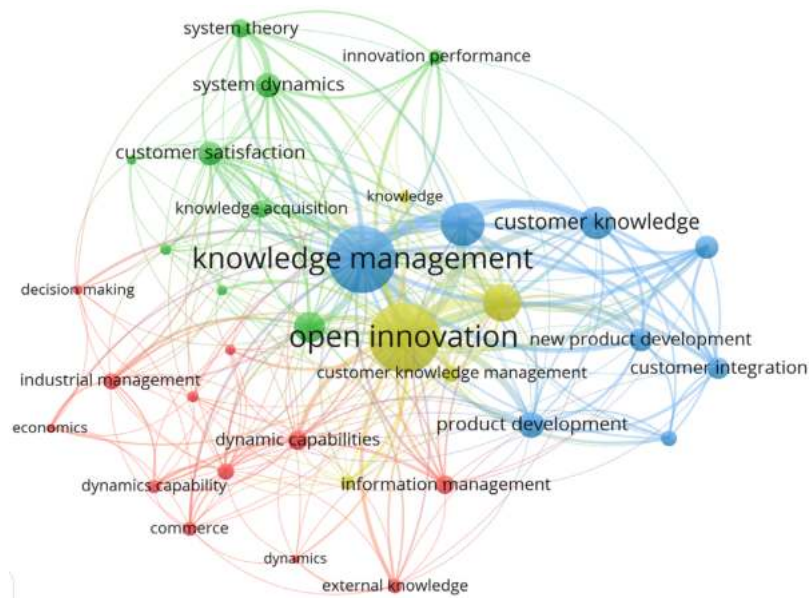


Figure 1. Bibliometric analysis: KD, CKM, OI.
Source: author's research

A first observation regarding the relationship between the concepts under analysis is that they are strongly influenced by knowledge's strategic positioning as a critical resource. The distribution of terms in clusters collectively reinforces the literature's emphasis on knowledge's essential role as a strategic resource for decision-making, OI, performance, and value creation.

Cluster 1

Table 3

Keyword	Cluster	Occurrences	Link	Link strength
Commerce		4	19	15
Decision making		4	10	12
Dynamic capabilities		8	17	28
Dynamics	Cluster 1 - Dynamic capabilities	4	8	10
Economics		4	8	11
Enterprise resource management		4	17	23
External Knowledge		4	12	19
Industrial management		5	16	23
Information management		5	17	26
Knowledge-based systems		4	13	14
Knowledge creation		5	11	13

Aligned with comprehensive literature reviews, Cluster 1 provides a solid foundation for understanding the intricate connections within the thematic cluster (Mele et al., 2024). Dynamic capabilities, the core of the first cluster, focus on the strategic adaptability of organizations to environmental changes (Mele et al., 2024). Having a co-occurrence of 8 and a total link strength of 28. It delineates strong interconnections with management processes, decision making, economics, e-commerce, information management, knowledge creation, external knowledge, and knowledge-based systems. Beyond the cluster, dynamic capabilities strongly link KM, OI, knowledge, innovation performance, and product development, highlighting its pivotal role in organizational innovation capabilities.

The analysis of Cluster 1 terms reveals the strong reliance on dynamic capabilities on knowledge resources accumulated within organizations (Decarolis & Deeds, 1999; Paarup, 2006). Enterprise resource management systems produce vast data, requiring effective information management practices for decision making and strategic planning (Mele et al., 2024). KM lays the foundation for knowledge-based systems, which is evident in the bibliometric analysis link between information management and KM (Cluster 3). Information management involves organizing, storing, and accessing structured data, facilitating KM processes crucial to decision making automation and knowledge sharing (Fotache, 2013; Jyhjong, 2007; Năstase & Hotăran, 2011; Vătămănescu et al., 2022)

Knowledge-based systems enable the creation and acquisition of knowledge using advanced technologies such as AI and machine learning to extract useful information from data (Mele et al., 2024). By stimulating knowledge exchange with the external environment, this cluster illustrates how organizations attract external knowledge, enhancing their competitive advantage through collaboration and OI initiatives (Mele et al., 2024). External sources of knowledge, such as industry trends and customer feedback, inform strategic decision making processes, identify emerging opportunities, and mitigate risks.

Through the highlighted connections, this Cluster illustrates that the development of knowledge exchange processes with the organization's external environment contributes to generating and attracting external knowledge. In other words, by connecting the terms highlighted by the cluster, we evade the fact that applying KD in external communication increases the external flow of knowledge coming to the organization.

Cluster 2

Table 4

Keyword	Cluster	Occurrences	Link	Link strength
Competition		9	24	48
Customer satisfaction		10	17	36
Information technology		4	11	12
Innovation performance	Cluster 2 – Customer satisfaction	5	12	20
Knowledge acquisition		6	16	24
Performance		5	11	13
Societies and institutions		4	12	14
System Dynamics		9	17	37
System Theory		7	12	27

The second Cluster is focused on the concept of customer satisfaction, which is the most strongly represented concept, registering a co-occurrence of 10 and a total link strength of 36. Customer satisfaction is one of the main goals of any active organization. It is the engine that drives companies to innovate, improve their services, adapt to customer needs, and improve their services and products (Paarup, 2006; Kim & Mauborgne, 2004). From this perspective, the company's power to attract and acquire new knowledge allows the company to develop products and services that meet the needs of its customers and increase customer satisfaction (Amatulli et al., 2019; Mittal & Kamakura, 2001). Thus, serving as a catalyst for OI within organizations.

Going further with the analysis, we can say that this begins a constant cycle of knowledge exchange that allows OI practices. At a practical level, the process of acquiring new knowledge has a significant impact on the System Dynamics within organizations. As organizations acquire new insights and knowledge, an adaptation of internal systems and processes is needed to effectively incorporate and leverage this knowledge so that it leads to the achievement of desired performance (Castagna et al., 2020; Sijabat, 2022; Shah et al., 2023). In this context, information technology plays a crucial role in improving organizational performance (Vătămănescu et al., 2023)

Cluster 3

Table 5

Keyword	Cluster	Occurrences	Link	Link strength
Co-creation		4	12	21
Customer integration		5	13	32
Customer knowledge	Cluster 3 – knowledge management	9	18	53
Integration		5	13	35
Knowledge management		31	31	129
New product development		5	13	34
Product development		7	21	40
Sales		16	26	75

Cluster 3 highlights the central role of KM in this analysis, being the mother concept for CKM, and KD (Rollins, 2005) records a close external cluster bond with the concept of OI, having a bonding power of 20. The KM cluster records this cluster as having an appearance of 31 and a total bond power of 129. Cluster 3 once again highlights the consumer and knowledge concepts as the central elements of the analysis, being the main links between the three key concepts. The OI and CKM perspective includes positioning consumers as co-creators of products and services and developing their active involvement, through the exchange of knowledge, in the development and innovation processes of the company. This is achieved through KD-based communication that facilitates knowledge exchange and creates trust transfer.

OI is based on new knowledge that stimulates growth and success in the organization, which involves the integration of consumers into the co-creation

processes. In this context, the present cluster once again validates the importance of KD's involvement in consumer communication for developing the co-creation process to meet the main requirement of the OI process (Dandonoli, 2013; Ruoslahti, 2018). Through the co-creation process, companies can access and collect new knowledge about customers, building a strategic link between their development processes and the needs and wishes of their customers. Knowledge of customers, type RK, EK, SK, represented by perspectives, impressions, preferences, experiences, needs, desires, and behaviors (Bratianu, 2022), are those that enter the process of CKM. KD thus serves as a foundation for effective co-creation that facilitates the development of OI processes.

KM effectively ensures that organizations use internal and external knowledge to lead successful OI processes. Without being integrated into the intellectual capital of the organization, external knowledge cannot be used to its potential (Bratianu & Bejinaru, 2023; Gibbert et al., 2002; Lievens et al., 1999).

Cluster 4

Table 6

Keyword	Cluster	Occurrences	Link	Link strength
Customer knowledge management		6	14	23
Innovation	Cluster 4 – Open Innovation	15	24	62
Knowledge		6	9	14
Open innovation		38	12	136
Social media		5	13	18

Cluster 4, called generic OI, is the smallest but most concentrated cluster for this research. It concludes and reinforces the theoretical assumptions noted to date. Within this cluster, OI records an appearance of 38 and a bonding power of 136, making it the strongest concept in the entire analysis. OI is a dynamic process that requires generating new knowledge within organizations based on integrating external, tacit, and explicit knowledge flows (Lindengaard, 2010).

When customers are involved in the design of services through OI, an open atmosphere is created that favors the generation of new service ideas (Piller et al., 2004). This newly generated knowledge contributes to the organization's intellectual capital, enriching its knowledge base and improving its capabilities for future innovation efforts. Knowledge itself thus becomes the main catalyst for OI practices. OI becomes a constant flow of knowledge exchange that should include both the transmission of RK, EK, and SK and the capture from the external environment of the same types of knowledge. CKM practices complement OI processes and enable the constant integration and utilization of knowledge. This dynamic exchange of knowledge with the external environment fuels the innovation process. CKM is essential in driving organizational innovation, and this cluster highlights this link. By systematically collecting, analyzing, and applying

customer knowledge, including RK, EK, and SK, organizations can identify unexplored opportunities for OI.

5. Conclusions and limits of the study

The present research highlights the dynamics of interconnections around the key concepts of CKM, KD, and OI, providing a new perspective on the benefits of using these concepts in business practices and highlighting the unexplored relationships between concepts. One constant that needs to be highlighted is that concentrated elements such as knowledge, consumer, transfer of knowledge, exchange of knowledge, and co-creation are at the core of the concepts. However, the main link between the three is KM, which denotes a gap in the in-depth exploration of the conceptual link achieved through this study. Calculated and organized interaction by KD involving both SECI activities and the transfer of RK, EK, and SK can generate valuable exchanges of knowledge that are appropriately integrated and used accordingly at the organization level to generate process improvements, innovations, anticipation of trends and trends, increased customer satisfaction and increased revenue.

From this research, we again highlight that CKM is positioning itself as a critical engine of the OI. By leveraging CKM, organizations can develop marketable products and services that meet consumer needs and preferences, thereby increasing perceived quality and customer satisfaction (Lievens, 1999; Slater et al., 2014). In conclusion, this research illustrates that integrating KD in external communication amplifies the impact of CKM systems by facilitating the exchange of knowledge between organizations and clients. This integration makes OI processes more efficient by positioning consumers as active co-creators on the innovation journey. By engaging in such a process of collaboration with customers, organizations can take advantage of the collective wisdom of their clients, developing strategies that lead to performance.

The study's findings underline the interconnection between CKM, KD, and OI, shedding light on the core mechanisms that drive organizational success in today's dynamic business landscape.

The present study, however, is a qualitative analysis and a subjective interpretation of the data collected. Also, the VOSviewer software algorithm can influence the interpretation of the results. Another limitation is that the database, which does not include all the works developed, is based on a selection from the public databases based on the established criteria, which diminishes the spectrum of interpretation. A broader bibliometric examination of these topics would be more able to take into account the qualitative nuances in individual research publications and the contextual complexities of the field. However, these limitations open up new research opportunities; subsequent studies could overcome present limitations by including more extensive databases and developing quantitative studies to better understand concepts.

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