

# Investigating the role of knowledge management in the pharmaceutical sector: a systematic review

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## Abstract

**Background:** The pharmaceutical sector, in its routine operations, heavily relies on numerous collaborators who exchange knowledge to maintain high-quality pharmaceutical care. This study examined the extent to which Knowledge Management (KM) impacts organisational performance, identifying the enablers and challenges to effective KM in the pharmaceutical industry. Lack of robust KM strategies is a threat to patient safety as it is linked to drug development delays, supply chain disruptions, medication errors and poor treatment outcomes.

**Methods:** A systematic literature review following PRISMA was conducted on Google Scholar to examine the role of KM initiatives in pharmaceutical organisations. A total of 21 peer-reviewed papers published in the English language from the year 2013 to date, focusing on KM within the pharmaceutical sector, were included in this study. The articles were selected, screened and examined following the inclusion and exclusion criteria.

**Results:** A positive relationship exists between Knowledge Management (KM)/Knowledge Sharing (KS) and Organisational Performance (OP), with significant  $R^2$  values ranging from 0.255 to 0.281. The study revealed that knowledge sharing specifically emerged as a significant predictor of organisational performance ( $p < 0.05$ ) and organisational agility ( $\beta = 0.348$ ). These findings suggest that effective KM strategies contribute to business performance optimisation, reinforcing the strategic importance of KM in organisational success.

**Conclusion:** The pharmaceutical industry can benefit from establishing cross-functional knowledge maps, implementing formal tacit knowledge transfer, developing clear SOPs for knowledge capture and transfer, and ensuring mobile accessibility of knowledge resources. Implementing these KM strategies contributes to higher productivity, quality products and services, market expansion, and increased revenues.

**Keywords:** knowledge management, pharmaceutical organisations, knowledge sharing, barriers, enablers, organisational learning

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## Introduction

The pharmaceutical industry works tirelessly to create medications and treatments that can save lives, leading the way in innovation. In 2023 alone, the pharmaceutical industry spent US\$300 billion on Research and Development (R & D).<sup>1</sup> Nonetheless, this industry has many obstacles to overcome, such as protracted research and development cycles, strict regulatory requirements and the ongoing need for innovation in a market that is becoming more and more competitive. Pharmaceutical companies are finding that KM is an essential tool for driving innovation, streamlining operations and preserving a competitive edge in this complex landscape. With new medicines continuously entering the market, new developments in the regulatory field and an expanding focus on customised treatments, there is an increased demand for well-informed and flexible pharmaceutical personnel.<sup>2,3</sup> Through standardisation of best practices across facilities, there is improved tracking and sharing of adverse events, quicker access to drug safety information and alerts, and improved prevention of medication errors through shared learnings.<sup>4,5,6</sup>

Knowledgeable staff is crucial for any organisation, notwithstanding its type, anatomy, processes and services.<sup>7</sup> This knowledge

entails a wide array of information that combines experience, rational thought, observation, education, skills and competencies.<sup>8,9</sup> Managing this organisational knowledge involves a set of activities and initiatives employed by an organisation to generate, gather, disseminate and effectively utilise the knowledge.<sup>10</sup> Hu et al.<sup>11</sup> describe KM as an array of competencies and skills an organisation uses to obtain useful information and efficiently share it within the organisation to enhance its activities. In other words, KM is the methodical harmonisation of an organisation's workforce, infrastructure, workflow and structure to get value by exploiting and executing creative concepts.<sup>9</sup>

In the pharmaceutical sector, KM extends beyond just saving and retrieving information. It involves the strategic generation, dissemination, and utilisation of knowledge throughout the entire industry, spanning from drug formulation to patient treatment. Novel treatment solutions require effective knowledge-sharing and collaborative efforts to address health issues.<sup>10</sup>

Thus, the significance of KM in making decisions to enhance pharmaceutical care requires implementing effective approaches to handling knowledge and ultimately facilitating accurate clinical decisions.<sup>2,3</sup> Efficient knowledge management systems position

organisations to tackle these issues with skill and proficiency, promoting the development of life-preserving medicines.<sup>6</sup> For instance, Moderna's swift creation of its COVID-19 vaccine underscores the power of effective KM systems as the vaccine quickly reduced transmission and offered protection against severe disease and its long-term health consequences.<sup>11</sup> In a similar manner, the efficient use of information and resources to improve customer experience and operational efficiency by the Dischem pharmacy chain in South Africa can be attributed to KM.<sup>12</sup>

### Problem statement

This study seeks to understand the role of KM practices, the extent to which KM contributes to organisational effectiveness as well as determining the enablers and challenges to effective KM in the pharmaceutical sector. The pharmaceutical sector is knowledge-driven due to R&D initiatives demanded by modern treatment requirements and the need for continuous innovation.<sup>13</sup> Even though the crucial function of KM in promoting innovation and regulatory compliance is well-founded, many pharmaceutical organisations face challenges in implementing KM initiatives.<sup>5,11,14</sup>

The inability to execute strong KM strategies can come at a great cost to the pharmacy profession, often with ramifications. Poor KM is associated with patient safety concerns, medication errors, and poor treatment outcomes.<sup>15</sup> Moreover, a lack of elaborate KM initiatives impedes the ability of pharmaceutical personnel to be involved in evidence-based practices, leading to the adoption of obsolete or inappropriate interventions.<sup>3</sup> This can eventually compromise the quality of pharmaceutical care pharmacists provide and have negative health consequences.<sup>15</sup> Pharmaceutical firms will also face drug development delays, problems with regulatory compliance, supply chain interruptions and a slow market response.

Although KM is growing in popularity as an essential component in enhancing pharmaceutical care and streamlining operations, there is a lack of understanding of the best practices in different pharmaceutical environments. The resultant knowledge gap is a hindrance to the pharmaceutical firms' development of appropriate KM strategies that tackle specific difficulties and barriers in modern pharmaceutical practices and enhance their overall competitive position. By addressing this knowledge gap, this systematic review offers some actionable insights and strategies that could help pharmaceutical companies enhance their capacity for innovation, operational effectiveness and KM.

### Theoretical framework

Two types of knowledge have been presented in the literature, specifically tacit knowledge and explicit knowledge. Kothari et al.<sup>16</sup> explain that tacit knowledge is gained through experience and is hard to convey, while explicit knowledge is documented, frequently defined by its formality and easier to express. However, these two types of knowledge do not exist in isolation but are rather intertwined through relationships and exchanges between people.<sup>17</sup>

Attard et al.<sup>17</sup> explain the concept of 'Ba', a common stage or area for knowledge generation and exchange, whether mental or physical. The authors further state that 'Ba' entails the exchange of tacit knowledge (emotional feelings, encounters, mental images) and creates teams amenable to exchanging cultures, traditions, procedures and moral principles. In this way, there is an absorption of explicit knowledge by individual members, expanding their tacit knowledge base as formalised knowledge is related to personal encounters, which are then disseminated and employed in practice to solve organisational problems.<sup>18</sup>

Among the several theories, concepts and approaches to KM, the Socialisation, Externalisation, Combination, and Internalisation (SECI) model is broadly regarded as an important and most widely used theoretical framework to guide KM research.<sup>19</sup> The SECI model regards knowledge generation as an evolving process with constant interaction between tacit and explicit knowledge resulting in socialisation (tacit to tacit), externalisation (tacit to explicit), combination (explicit to explicit) and conversion of explicit to tacit through internalisation.<sup>18,19</sup> The SECI model is enabled by the 'Ba' platforms through the provision of the right atmosphere for knowledge provision processes.<sup>20</sup> In real life, 'Ba' is implemented by interactions such as brainstorming meetings, mentorship activities and online knowledge sharing.<sup>17</sup>

However, the SECI model is riddled with flaws and limitations. Bandera et al.<sup>20</sup> point out that the validity of the model was only shown for the manufacturing firms in Japan and its application may not be generalisable to other organisations. Farnese et al.<sup>17</sup> criticise the model for lacking a solid foundation based on evidence on how it could be applied in practice. Furthermore, Adesina and Ocholla<sup>18</sup> posit that the model fails to take into account the context of use, disregards the learning theory, and is linear and simplistic, making it difficult to codify other knowledge forms.

Bearing in mind that no model is perfect, the SECI model is still very useful in understanding the strategic use of knowledge in organisations as some studies<sup>17,18,19,20</sup> have applied it in KM research. Since it has been used for the majority of KM conceptualisation or descriptive purposes in case studies, the SECI model is considered a theoretical landmark.<sup>18</sup> In addition to fostering innovation and offering a framework for knowledge management procedures, the SECI model assists organisations in understanding how knowledge is produced and disseminated within teams.<sup>17,19</sup>

### Literature review

#### Knowledge sharing

Since merely generating and storing knowledge is not enough, people within organisations must share it for it to be useful. The dissemination of knowledge occurs through social interaction where effective techniques are supported and repetition is avoided.<sup>21</sup> Indeed, the cost of this repetition is greatly reduced by knowledge-sharing systems that empower workers and teams to map out solutions efficiently.<sup>22</sup> Knowledge-sharing

describes various actions and methods (e.g. training sessions and workshops, mentoring programmes, storytelling and anecdotal sharing, discussion forums, online communities and lessons learned databases) people employ to disseminate knowledge into goals, competencies, concepts, information, strategies, creativity and insights that fellow workers can understand.<sup>23</sup> After sharing knowledge, the receiver must then process it in a context that will culminate in the creation of new knowledge.<sup>24</sup>

Although Lilleoere and Hansen<sup>21</sup> qualitatively explored KS methods in pharmaceutical R&D, their findings cannot be generalised to other comparable units or areas of pharmaceutical practice. Similarly, although Qureshi and Evans<sup>22</sup> examined obstacles to knowledge-sharing within and outside the pharmaceutical environment, their data emanated from a single case, limiting the application of the empirical findings. The pharmaceutical sector will therefore benefit from a multiple-case study that examines KS techniques and obstacles within and across organisations.

### **Benefits of knowledge management**

The field of pharmacy is intricate and utilises vast amounts of knowledge, which is anchored on experience.<sup>25</sup> According to Xu and Wei,<sup>23</sup> KM activities have been associated with efficiency, business growth, positive corporate culture, high revenues and reduced costs. The work by two studies<sup>11,15</sup> indicates that KM can predict internal processes in community pharmacies and that rapid growth in competition among businesses is catalysed by knowledge used to enhance productivity. However, even though Mukuria et al.<sup>15</sup> demonstrated a statistically significant relationship between KM and retail pharmacy performance, they did not examine the long-term effects of KM.

Since these intellectual resources can be viewed as a secret weapon used by organisations to attain competitive advantage, KM aims to amass knowledge that creates unique skills that lead to superiority.<sup>4,8</sup> Ajie and Opeke<sup>26</sup> explain that when workers exchange knowledge among themselves and teams, the organisation can leverage its intellectual assets. However, their research indicates that KM impacts financial more than non-financial performance, possibly due to the control on medicine prices.

Effective use of KM by pharmacists is crucial to enhance the quality of pharmaceutical care as technological advancement or context influences professional practice.<sup>25</sup> For instance, tacit knowledge can come in handy in an ethical dilemma where a pharmacist is required to issue a prescription medicine for emergency use, to a person without a prescription.<sup>27</sup> While the findings that KM capacity firms pharmaceutical organisations' competitive edge<sup>11</sup> are important, the role of strong collaboration, coordination and communication between departments ought to be investigated.

### **Knowledge management strategies**

Kothari et al.<sup>16</sup> presented multiple KM strategies that encompass simple techniques (e.g. educational seminars and training), communities of practice, and workflow-based frameworks. Mapping skills and resources is another strategy to enhance KM

in an organisation.<sup>14</sup> This mapping approach functions on the premise that the organisation's leadership or external forces may mobilise latent capacity.<sup>16</sup> Mapping knowledge involves gathering information on the knowledge held by each individual which enables the organisation to identify its key knowledge assets and coordinate knowledge-related activities.<sup>28</sup> This coordination may culminate in organisational training, which may be online or otherwise, including debriefings by retiring or resigning experts.<sup>16</sup>

Technology is an essential element of a healthy KM strategy and is now key to pharmaceutical care. Technology is deemed an important solution to enhance pharmaceutical care, the management of patients, the identification of novel interventions and the carrying out of research.<sup>6</sup> While the anatomy of technological systems may differ from one organisation to another, the system facilitates codification, organisation, distribution and maintenance of the organisation's intellectual assets.<sup>16</sup> The strategy of codifying and personalising knowledge effectively aligns with the therapeutic tenets and goals by promoting knowledge exchange and use among healthcare workers.<sup>29</sup>

However, to successfully implement a technology-driven approach, a thorough understanding of the organisational KM activities is needed.<sup>25</sup> Technological innovation is an integral part of KM because technology facilitates the seamless transfer of information which is achieved through the implementation of a system that offers a technical basis.<sup>6</sup> For instance, Shahmoradi et al.<sup>6</sup> revealed that the use of Electronic Health Records (EHR) and Clinical Decision Support Systems (CDSS) streamlines the flow of information between healthcare professionals while enhancing decision-making. As such, these tools are resourceful in constructing interactive techniques that support healthcare professionals in creating knowledge, significantly enhancing patient safety<sup>25</sup> and efficiency, buttressing the benefits outlined by Chiekezie et al.<sup>4</sup>

Technology also enables the creation of discussion platforms using social media such as WhatsApp. Forums formed inside organisations that use smartphone messaging encourage swift conversations permitting members to refer to given knowledge sources and authenticate arguments with their colleagues.<sup>28</sup> The work of Bruce et al.<sup>30</sup> empirically demonstrated that the use of social media in healthcare notably enhances patient-doctor interactions, conveyance of information, patient education and crisis management. However, the use of technology can be marred by high setup costs, poor internet connection, system breakdowns, lack of support and data protection issues.

Another strategy utilises Communities of Practice (CoP), which are groups of people who share a common concern. These communities operate on three pillars: the domain of skills and knowledge exhibited by participants; relational links and psychological attachment among participants; and the collective structures, concepts and resources that participants utilise in their work.<sup>16</sup>

Boundary spanning among CoP enables another benchmarking strategy, where lessons can be drawn from other organisations by exchanging knowledge on the most workable practices.<sup>28</sup> This establishes a favourable working culture, and an increase in profits and growth highlighted by Xu and Wei.<sup>23</sup> However, Kothari et al.<sup>16</sup> caution that virtual CoP may be inappropriate to satisfy every organisation's KM requirements, indicating that all-encompassing KM strategies are neither attainable nor desired.

### **Barriers to effective KM**

Literature is replete with barriers and enablers of knowledge management categorised into organisational, technological, and individual-related. In the pharmaceutical sector, Qureshi and Evans<sup>22</sup> highlight the failure to distinguish tacit from explicit knowledge, the inaccessibility of knowledge, physical and social borders among workers and the lack of valuable knowledge as some of the organisational obstacles to KM. For instance, various research teams or departments can operate independently, hesitant to exchange information because of communication gaps or rivalry. Poor leadership backing, lack of KM champions, lack of resources to implement changes, inadequate infrastructure, and workplace incivility promoted by abusive leadership<sup>16,31</sup> are clear obstacles to KM, including lack of time<sup>12</sup> and lack of executive support.<sup>16</sup>

Workers' poor absorptive capacity, strained relationships between colleagues, inadequate social skills, and the perception that intellectual capital is lost through knowledge exchange were highlighted as barriers to KM.<sup>14,22</sup> Lilleoere and Hansen<sup>21</sup> emphasise that personal beliefs can interfere with knowledge-sharing, for instance, pharmacy workers who are accustomed to their current methods may be reluctant to adopt new knowledge management practices. Lack of motivation and information overload, poor technological competence and inadequate qualifications to occupy certain positions all negatively impact healthcare knowledge-sharing.<sup>16</sup> However, Lilleoere and Hansen<sup>21</sup> indicate that motivation is loosely related to knowledge transfer, implying that knowledge dissemination is not enough for effective knowledge-sharing.

Healthcare technology can be a hindrance to KM due to restricted accessibility to contemporary technology, unfriendly user interface and interoperability problems.<sup>6</sup> Pharmaceutical organisations may face obstacles to KM in inconsistent, malfunctioning or incompatible software and the difficulty of procuring the programme to act as the knowledge base.<sup>22</sup> For example, outdated or incompatible inventory management systems may hinder effective data sharing and analysis across pharmaceutical organisation departments. However, Qureshi and Evans<sup>22</sup> note that these hindrances to KM neither emanate from nor were they empirically tested in the pharmaceutical sector. It is important to carry out case studies in pharmaceutical organisations with effective or failed KM practices to obtain an empirical understanding of the barriers and effective methods to mitigate them.

## **Methodology**

This review conformed to Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) requirements.<sup>32</sup>

### **Search strategy**

A thorough literature search was carried out on Google Scholar to find relevant publications on knowledge management in the pharmaceutical sector. The following keywords were used in the search criteria: "pharmacy", "knowledge management", "pharmacist", "pharmaceutical care", "knowledge-sharing", and "evidence-based practice". Previous studies<sup>33,34</sup> have carried out systematic reviews from a single database, the Web of Science. Logical operators like the "AND" and the "OR" were used to improve the search queries. The broad scope of this research and the availability of a wide range of pertinent sources are ensured by Google Scholar's well-known extensive indexing of academic journals, conference proceedings, theses, and institutional repositories. The review was restricted to works published between 2000 and 2024 to capture the evolution of KM in the pharmaceutical sector since the turn of the millennium. According to Kothari et al.,<sup>16</sup> although KM in other sectors such as business and public policy practised KM from the early 1990s, it only started to gain traction in the healthcare field around 2000.

### **Inclusion and exclusion criteria**

The inclusion criteria accommodated full-text studies that (a) are open access; (b) are peer-reviewed or conference papers; (c) focus on KM in the pharmaceutical sector; (d) are published in English; (e) are published from 2000. Editorials, opinions, unpublished and other non-research articles were excluded.

Data extraction and screening were carried out by two separate researchers. To agree, the two researchers first discussed any differences. A third researcher independently examined the contentious issues and rendered the final decision in situations where discussion failed to produce consensus. The data extracted include the author(s), year, study design, population, KM strategies, barriers and facilitators and main findings.

### **Data analysis**

Thematic analysis was used to locate repeating themes and trends within the extracted data. The synthesis was based on: (1) KM execution in the pharmaceutical field; (2) the barriers to KM in the pharmaceutical field; (3) the facilitators of effective KM strategies; (4) the KM strategies, solutions, or best practices for KM; and (5) impact of KM on pharmaceutical organisations. Initially, the researchers familiarised themselves with the data by meticulously reviewing the incorporated studies to acquire an in-depth comprehension of their material. Crucial themes, results or propositions were identified and manually labelled with codes. These preliminary codes were methodically grouped into possible themes, with the aid of visual mind mapping to investigate code relationships. An iterative review of the theme development process was conducted against the coded extracts

and the complete dataset to guarantee internal consistency and the formation of coherent patterns. Regular researcher meetings helped to refine the themes and provide precise definitions for each one. To make sure themes appropriately reflected the content, a third researcher independently reviewed the papers as part of the validation process. This study followed Synthesis Without Meta-analysis (SWiM) as the focus is on understanding concepts, experiences, or perceptions rather than quantifying effect sizes. The inter-rater reliability was assessed through Cohen's kappa by feeding the data into the PSPP software.

### Quality assessment

A checklist proposed by Kitchenham and Charters<sup>35</sup> and adopted by Almansoori et al.<sup>36</sup> was used to assess the quality of the studies. The checklist contains nine questions which can be answered by a Yes (1 point), No (0 point), or a 0.5 point if the answer is between yes and no. A total score of between 0 and 9 indicates the extent to which a study answers the research questions. Any score below 4.5 (50%) indicates shortcomings in a study. The nine questions that form the basis for the assessment are as follows:

- Is the research aim specified clearly?
- Did the study achieve its aim?
- Are the variables considered by the study clearly indicated?
- Is the context/discipline of the study clearly defined?
- Are the methods of collecting data sufficiently detailed?
- Is the study describing the measure's reliability and/or validity?
- Are the statistical techniques used to analyse the data sufficiently described?
- Do the findings add to the literature?
- Does the study add to your knowledge or understanding?

A sample of ten randomly chosen articles from our initial search was used for the pilot test. The modified checklist was independently used by two researchers to assess the comprehensiveness, clarity, and applicability of the pharmaceutical KM literature.

## Results

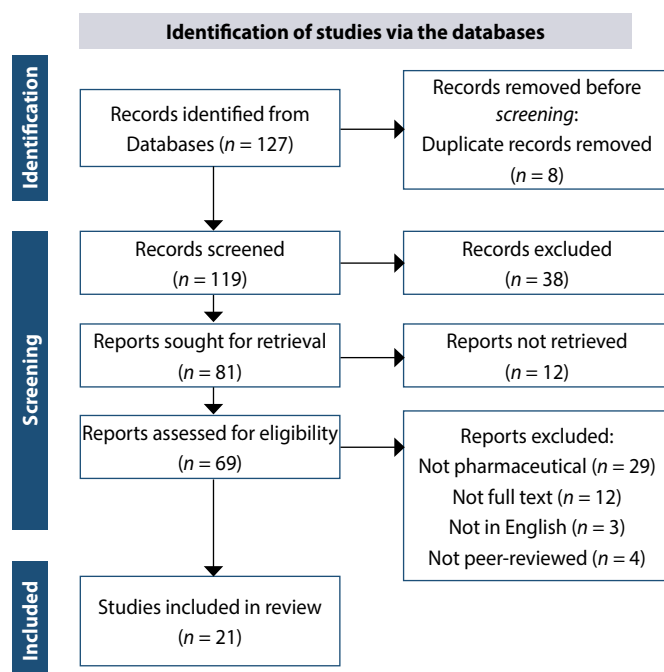
### Search results

The search process outlined in the PRISMA diagram in Figure 1 yielded 21 articles reviewed in this study. Even though the target was from 2000, the first paper meeting the criteria emerged in 2013.

### Study characteristics

The publishing period of the articles ranged from 2013 to 2024. Most of the studies were quantitative (85.7%) with only three qualitative studies (14.3%) and no mixed methods studies. Most of the studies targeted industrial pharmacy with only two studies conducted in community pharmacies and one in a hospital pharmacy. The study characteristics are shown in Table I.

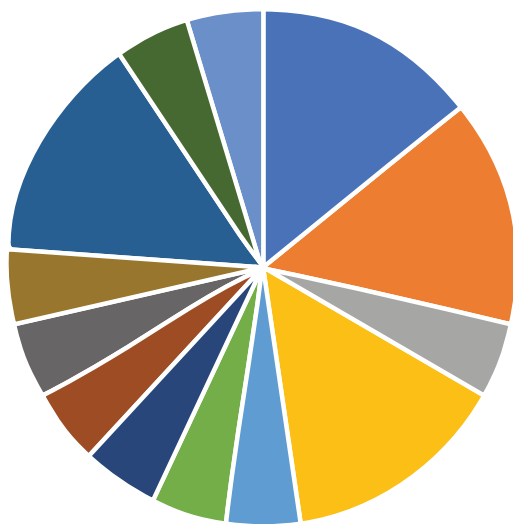
Author/year	Study design	Sample size	Percentage
Ajie & Opeke <sup>26</sup>	Quantitative	362	10.37%
Altaher <sup>24</sup>	Quantitative	224	6.42%
Chiekezie et al. <sup>4</sup>	Quantitative	40	1.15%
Christopher et al. <sup>38</sup>	Quantitative	289	8.28%
Dongo <sup>37</sup>	Quantitative	26	0.74%
Hu et al. <sup>11</sup>	Quantitative	308	8.83%
Filieri et al. <sup>46</sup>	Qualitative	18	0.52%
Haque & Islam <sup>39</sup>	Quantitative	160	4.58%
Hung et al. <sup>47</sup>	Quantitative	98	2.81%
Lilleoere & Hansen <sup>21</sup>	Qualitative	19	0.54%
Mukuria et al. <sup>15</sup>	Quantitative	116	3.32%
Priyavarsha & Sudha <sup>3</sup>	Quantitative	340	9.74%
Qureshi et al. <sup>22</sup>	Qualitative	7	0.20%
Rafique et al. <sup>7</sup>	Quantitative	120	3.44%
Riaz & Hassan <sup>40</sup>	Quantitative	203	5.82%
Saini <sup>41</sup>	Quantitative	50	1.43%
Salih et al. <sup>8</sup>	Quantitative	104	2.98%
Shwiemeh & Yildiran <sup>45</sup>	Quantitative	206	5.90%
Sontoso et al. <sup>31</sup>	Quantitative	311	8.91%
Yuen et al. <sup>9</sup>	Quantitative	379	10.86%
Zubair et al. <sup>48</sup>	Quantitative	110	3.15%
		<b>3490</b>	<b>100.00%</b>



**Figure 1:** PRISMA flow diagram representing the search process

### Distribution of the studies

The studies were conducted in various countries, including Hong Kong, India, Jordan and Nigeria among others. Nigeria, India, Pakistan and Jordan constituted the greatest number of studies,



Kenya; 1  
 Pakistan; 3  
 Jordan; 3  
 Indonesia; 1  
 Nigeria; 3  
 Namibia; 1  
 Ireland; 1  
 Denmark; 1  
 Australia; 1  
 Hong Kong; 1  
 Taiwan; 1  
 India; 3  
 Bangladesh; 1

Figure 2: Proportion of the studies by country

with three each, accounting for about 57% of the total. Each of the remaining nine nations – Indonesia, Denmark, Bangladesh, Taiwan, Hong Kong, Australia, and Namibia – contributes one study to the review.

**Outcomes measured**

The outcomes of interest found across the studies include competitive advantage, organisational performance, innovation, knowledge sharing, and absorptive capacity. Organisational performance was measured in eight studies and innovation was measured in seven studies. Competitive advantage was an outcome of interest in five studies while knowledge-sharing was measured as an outcome in five papers. Only one paper was interested in absorptive capacity as an outcome.

**Knowledge sharing and organisational performance**

Based on the extracted data, Table II summarises the key findings related to the impact of knowledge sharing on organisational performance. Knowledge sharing is a priority for organisations and significantly impacts the various elements of organisational growth. Organisational performance is at the core of the thematic map.

**Table II: A summary of the effect of knowledge management on organisational performance**

Study	Sample size	Statistical tool	Statistical result	Implication
Ajie & Opeke <sup>26</sup>	362	Simple linear regression	R <sup>2</sup> = 0.281, p < 0.05	KS positively influences OP.
Christopher et al. <sup>38</sup>	289	t-test	t = 6.211, p = 0.000	KS and retention positively influence OP.
Haque & Islam <sup>39</sup>	160	Structural equation modelling	Chi Sq = 2.143 RMSEA = 0.085	IT infrastructure and performance measure improves business performance.
Mukuria et al. <sup>15</sup>	116	ANOVA	R <sup>2</sup> = 0.281, t = 7.333, p < 0.05	Strong =+ve relationship between KM and OP
Priyavarsha & Sudha <sup>3</sup>	340	Structural equation modelling	R <sup>2</sup> = 0.278, p = 0.000	KM has a +ve effect on OP
Riaz & Hassan <sup>40</sup>	203	Pearson correlation	Correl. = 0.172, level 0.01	Weak +ve correlation between KM process intention and OP
Saini <sup>41</sup>	50	Simple linear regression	R <sup>2</sup> = 0.255	KM explains a 25.5% variance in OP.
Salih et al. <sup>8</sup>	104	Multiple linear regression	t = 3.470, β = 0.348, level 0.05	The impact of KS on organisational Agility is +ve

KS = Knowledge Sharing, OP = Organisational Performance, KM = Knowledge Management

**Table III: KM barriers and facilitators**

Author	KM barriers	KM facilitators
Lilleoere & Hansen <sup>21</sup>	'Knowledge as power', no physical proximity to colleagues, 'not invented here', 'to know what to know', no or weak social relations.	Meetings, physical proximity to colleagues, relocation of professionals and social relations.
Qureshi and Evans <sup>22</sup>	High cost of KS, technology limitations, knowledge hiding, lack of socialisation, lack of trust, non-educational mind-set, organisational politics, poor leadership, and time pressure.	
Dongo <sup>37</sup>	Lack of time, staff resistance, unwillingness to learn, poor communication, staff shortage, lack of reference books, lack of staff rotation, poor understanding of KM, inadequate technology infrastructure, lack of knowledge repository.	Technology, organisational culture, training, active staff participation, WhatsApp.

## Barriers and facilitators of KM

Only 3 studies dealt with either barriers or facilitators of KM or both. The barriers and facilitators extracted from the studies are presented in Table III.<sup>21,22,37</sup>

## Quality of the studies

All the studies were assessed for quality and relevance. The scores ranged from 5 (55.6%) to 8.5 (94.4%). None of the papers were excluded for review on account of a score of less than 50%.

## Inter-rater reliability

Based on Cohen's Kappa analysis for inter-rater reliability across six themes in the systematic review, the kappa values for the themes are Knowledge-Sharing = 0.59, Organisational Performance = 0.81, Competitive Advantage = 0.77, Absorptive Capacity = 0.77, Innovation = 0.63 and Barriers and Facilitators = 0.83.

## Discussion

This paper examined the role of knowledge management as a strategy for capturing and sharing knowledge in the pharmaceutical sector.

The geographical distribution of the studies points to a worldwide interest in the subject, with developing nations in Asia and Africa receiving a little more attention than others. Despite the relatively low total number of studies per country, the diversity of countries represented suggests that KM in the pharmaceutical sector is an area of interest for international research. It is interesting to note that this research does not include data from some significant pharmaceutical markets, such as the United States, the United Kingdom or Germany. Different approaches to recording and disseminating KM practices may be the cause of this discrepancy. It is also possible that these practices are either proprietary information, part of larger organisational procedures or documented in non-academic formats like industry white papers and internal reports.

Eight studies examined the impact of KM on organisational performance.<sup>3,4,15,24,38,39,40,41</sup> Ajie and Opeke,<sup>26</sup> with the largest sample size of 362, examined the effect of knowledge-sharing on both financial and non-financial elements of organisational performance. Linear regression findings reported that knowledge sharing explains over 28% of the variance in organisational performance ( $R^2 = 0.281$ ,  $p < 0.05$ ). Businesses, like pharmacies, can increase employee performance by helping them learn about customers' preferences and then tailor their services to meet those needs.

Christopher et al.<sup>38</sup> also found a statistically significant association between knowledge sharing and organisational performance ( $t = 6.211$ ,  $p = 0.000$ ). However, Riaz and Hassan found only a weak positive correlation between KM process intention and organisational performance. This is in sharp contrast with the other seven papers. In a systematic review involving 16 articles, Kosklin et al.<sup>42</sup> indicate that KM can improve organisational

financial performance, which enables healthcare organisations to absorb financial stress.

Even though their systematic review is more thorough, contextual variations, performance measurement variations, employee intentions, mediating variable considerations and sample characteristics can account for the contradictory findings. For instance, the relationship between KM and organisational performance can be drastically changed by the presence of mediating variables, such as organisational creativity.

An organisation that advocates for knowledge sharing with trust and candour values its workers as a key resource of knowledge and encourages collaboration.<sup>16</sup> Lilleoere and Hansen<sup>21</sup> suggest that efficient KM could shorten product development cycles and highlight the value of knowledge sharing in accelerating the knowledge creation process within pharmaceutical R&D. Ajie and Opeke<sup>26</sup> concluded that socialisation and externalisation were the more prominent practices of knowledge sharing, in line with the SECI model, emphasising the importance of tacit knowledge in organisations. Tacit knowledge in pharmaceutical organisations includes insights like manufacturing process troubleshooting expertise, comprehension of drug development challenges and the conversion of explicit guidelines into intuitive practice wisdom, all of which improve patient care and safety.<sup>43</sup> Kucharska and Erickson<sup>44</sup> support this and conclude that tacit knowledge positively influences both innovation and organisational performance.

Five studies confirm evidence of the positive influence of KM on competitive advantage.<sup>4,8,11,21,45</sup> Chiekezie et al.<sup>4</sup> established a significant positive correlation between staff training and customer satisfaction (Correlation = 0.848, at the 0.01 level (2-tailed).

Hu et al.<sup>10</sup> demonstrated that three KM elements: innovative capacity ( $r = 0.403$ ); transformative capacity ( $r = 0.408$ ); and absorptive capacity ( $r = 0.460$ ), mediated by supply chain agility, positively influence competitiveness. In this systematic review, seven studies established similar findings, further affirming the role of KM practices in organisational innovation.<sup>3,9,21,38,40,46,47</sup> The interplay between knowledge-sharing and the intellectual capital of both individuals and the organisation promotes innovation and innovative attitudes,<sup>23</sup> leading to competitive advantage. To implement innovation and therefore competitive advantage, pharmaceutical firms must allocate resources towards the education and training of their staff and invest in research and development.<sup>8</sup>

This review also identified several barriers to KM which can be categorised into organisational, technological, cultural, personal and knowledge-related as shown in Table III. It is important to establish a culture of trust in which workers freely engage in knowledge-sharing while promoting socialisation, collaboration, and continuous learning.<sup>48</sup> Identifying barriers presents opportunities that pharmaceutical organisations must leverage for maximum benefit.<sup>49</sup> Managers and pharmacists in pharmaceutical

organisations must recognise these hurdles and co-opt trusted methods based on pharmaceutical systems' management.<sup>50</sup> These methods may include inculcating a culture of learning in teams, creating centralised databases, organised mentorship strategies, standardising knowledge capturing, incentivising knowledge exchange and strict regulatory compliance. Through the use of case studies, Krudys et al.<sup>10</sup> highlight how the regulatory system's KM can improve drug development and regulatory decision-making through the use of standardised data templates, queryable databases and collaborative frameworks.

Using a cross-functional structure allows harnessing knowledge from any part of the organisation, notwithstanding its location.<sup>16</sup> Conducting an assessment of the present workflows, identifying gaps and failures, applying the right tools and stakeholder involvement can add value and unlock more KM opportunities in the pharmaceutical sector. The results of this systematic review are supported by the high agreement on most themes, which also point to areas that could benefit from additional definition or coding process refinement. However, knowledge sharing's lower agreement indicates that to increase consistency, this theme might use a more precise definition or more rater training.

## Conclusion

The function of Knowledge Management in pharmaceutical organisations is undeniably crucial for improving the quality of patient care, safety, and streamlining the workflow. The study established evidence that KM practices are associated with pharmaceutical organisations' absorptive capacity, innovation, competitive advantage and organisational performance. Absorptive capacity drives knowledge assimilation, application and absorption which ensures expedited drug development, optimisation of workflows and strengthens regulatory compliance

This review also identified several hindrances to KM which can be classified into organisational, technological, cultural, personal and knowledge-linked. Pharmaceutical organisations must identify these barriers in their particular settings to streamline KM operations and unlock its benefits.

## Limitations

The study is limited to selecting research papers from a single database, which potentially results in selection bias. The study also did not conduct a meta-analysis which negatively impacts the generalisability of the findings.

## Recommendations

The pharmaceutical industry can benefit from establishing cross-functional knowledge maps, establishing clear KM governance structures and roles, implementing mentoring programmes to transfer tacit knowledge, developing clear SOPs for knowledge capture and transfer, implementing semantic search capabilities across repositories, ensuring mobile accessibility of knowledge resources and establishing Communities of Practice (CoPs) across departments to foster a culture of knowledge sharing. It

is worthwhile to conduct more research using a mixed methods approach or longitudinal studies in different pharmaceutical settings such as hospitals and retail pharmacies to capture the impact of KM and its long-term effects on various organisational aspects. There is a critical need for future research to specifically examine KM practices in countries like Germany, the USA and the UK, as the paucity of published studies from these top pharmaceutical markets restricts our comprehension of potentially novel KM practices and effective implementation strategies that could benefit the global pharmaceutical sector.

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We have no conflicts of interest to disclose.

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## Ethics

This study did not disclose any patient information. Issues relating to informed consent and ethical approval were not applicable.

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