International Journal of Scientific Research and Management (IJSRM)
||Volume||13||Issue||08||Pages||2402-2410||2025||
Website: https://ijsrm.net ISSN (e): 2321-3418
DOI: 10.18535/ijsrm/v13i08.sh03

Evolution, Contemporary Dynamics, and Societal Impact of the Pharmaceutical Industry: Global Trends and the Moroccan Context

Ibtihal Agoulmam

Mohammed V University, Faculty of Juridical, Economics and Social Sciences, Rabat, Morocco

Abstract:
The pharmaceutical industry has undergone a remarkable transformation, evolving from artisanal apothecaries in the 19th century to a globalized and technologically advanced sector in the 21st century. This article examines the historical evolution of the industry, highlighting key scientific and technological advances, including genomics, artificial intelligence, and biofabrication, which have reshaped drug discovery, development, manufacturing, and commercialization. It also analyzes the strategic adaptation of pharmaceutical companies through diversification, specialization, generics, biologics, and digital health investments. The contemporary pharmaceutical landscape, particularly in emerging markets such as Morocco, is explored, emphasizing the influence of global dynamics, regulatory frameworks, and economic pressures. Finally, the societal, ethical, and economic impacts of the industry—including access to medicines, innovation, and policy influence—are discussed to provide a holistic understanding of its role in global health and the economy.

Keywords: Pharmaceutical industry, historical evolution, scientific advances, drug development, biopharmaceuticals, personalized medicine, global health, Morocco, business strategies, ethical implications.

1. Introduction

The pharmaceutical industry has a rich and complex history, marked by major scientific breakthroughs, profound economic transformations, and persistent regulatory challenges. From its modest beginnings in medieval apothecaries to its current central role in the modern global economy, the sector has undergone a remarkable evolution. What was once a craft rooted in traditional medicine—based on plants, minerals, and animal products prepared by apothecaries—gradually transformed into an industrial and highly technological field driven by innovation, regulation, and globalization (Chkirida, 2020).

During the 19th century, the Industrial Revolution laid the foundation for the modern pharmaceutical industry by introducing mechanization, chemical standardization, and large-scale production. Companies such as Bayer, Merck, and Sanofi emerged as pioneers, discovering landmark drugs such as aspirin, morphine, and quinine. The 20th century witnessed a golden age of innovation with the discovery of antibiotics like penicillin and streptomycin, the development of life-saving vaccines by Salk and Sabin, and advances in molecular biology that revolutionized the understanding of genetic and cellular mechanisms. These milestones not only transformed healthcare but also redefined the pharmaceutical business model, enabling global expansion and increased specialization.

The post–World War II period was particularly significant, as pharmaceutical production became increasingly globalized, with generic medicines manufactured predominantly in developing countries and advanced biotechnology concentrated in the United States and Europe (Chkirida, 2020). By the 1990s, the sector had evolved into a dual system of specialization and globalization, marked by growing concerns over product quality, intellectual property, and accessibility. The 21st century is now characterized by personalized and precision medicine, as well as cutting-edge therapies including immunotherapy, gene therapy, and digital health solutions, reflecting a paradigm shift toward individualized treatments and data-

driven healthcare (Khanna et al., 2020; Gastineau, 2022; Nalbant & Aydın, 2023).

This trajectory has been profoundly shaped by scientific and technological advances. Artificial intelligence, machine learning, genomics, and systems biology are accelerating drug discovery, while digital platforms and real-world data are transforming commercialization strategies (Harvard Business Review, 2020; Champagne et al., 2020; Futura Health, 2023). At the same time, virtual clinical trials and 3D printing are revolutionizing drug development processes, and continuous manufacturing techniques are enhancing production efficiency. These changes are not only technological but also structural, as pharmaceutical companies adapt their business models through diversification, specialization, strategic alliances, and investments in digital health solutions.

Beyond science and business, the pharmaceutical industry plays a central role in public health and global economic development. It contributes to life expectancy improvements, chronic disease management, and pandemic responses, while also generating millions of jobs and driving innovation across scientific and industrial sectors (Gautier, 2023; Orabi & Bentaleb, 2020). Yet, these contributions coexist with ethical and social dilemmas, such as unequal access to medicines, high drug prices, antibiotic resistance, and the influence of pharmaceutical lobbying on public health policies (Darouich & Dhiba, 2020; Bimegdi, Belaiche & Ahid, 2023).

Taken together, the historical development of the pharmaceutical industry reflects the interplay between scientific progress, economic forces, and regulatory frameworks. Its evolution raises fundamental questions about equity, innovation, and sustainability in healthcare. Against this backdrop, this article explores the temporal evolution of the pharmaceutical industry, its contemporary framework and dynamics, and its broader societal and economic impacts, with a particular focus on the Moroccan context and its positioning in the global pharmaceutical landscape.

2. Temporal Evolution of the Pharmaceutical Industry: A Historical Perspective

Modern pharmaceutical companies trace their origins back to 19th-century pharmacies and chemical manufacturers. Production gradually globalized between 1890 and 1910, expanded further after the World Wars, and experienced strong international growth following World War II. By the 1990s, production had become more specialized: generic drugs were manufactured in developing countries, while biotechnological medicines were produced in the United States and Europe. The 21st century has been marked by personalized medicine and heightened vigilance regarding product quality (Chkirida, 2020).

Table 1: Evolution of Pharmaceutical Practices from 1890 to Today

Period	Events and Developments
1890–1910	Global expansion, post-war reconstruction, international growth.
1990	Specialized production, generics manufactured in developing countries, biotechnology in the U.S. and Europe.
1950–2000	Decline in demand for compounded medicines, rise of national pharmacy chains, emergence of personalized medicine, concerns over product quality.
Today	Resurgence of drug manufacturing in the U.S. despite ongoing challenges.

Source: Prepared by the author

2.1 Emergence and Development of the Modern Pharmaceutical Industry

The modern pharmaceutical industry underwent a remarkable transformation, evolving from artisanal

practices into a globalized and highly technological sector.

- **Before the 19th century**: Traditional medicine prevailed; treatments were based on plants, minerals, and animal products, prepared by apothecaries (Chkirida, 2020).
- **19th century**: The Industrial Revolution introduced mechanization and standardization, leading to the rise of the first major pharmaceutical companies such as Bayer, Merck, and Sanofi. Landmark drugs such as aspirin, morphine, and quinine were discovered.
- **20th century**: The golden age of antibiotics (penicillin, streptomycin) and the development of vaccines (Salk, Sabin), along with advances in molecular biology that enhanced the understanding of cellular and genetic mechanisms.
- **21st century**: Emergence of personalized medicine, innovative therapies (immunotherapy, gene therapy), and the globalization of pharmaceutical research, production, and commercialization.

The communication of medicines has evolved over time, shifting from traditional approaches to structured and diversified promotional strategies, reflecting the growth of pharmaceutical firms and their market influence (Coupevent, 2014).

2.2 Impact of Scientific and Technological Advances on the Pharmaceutical Industry

Scientific and technological progress has reshaped drug discovery, development, manufacturing, and commercialization:

- **Drug discovery**: Artificial intelligence and machine learning, genomics, and systems biology help identify new targets and design precise treatments (Khanna et al., 2020; Futura Health, 2023).
- **Development**: Virtual clinical trials and 3D printing accelerate testing and reduce costs (Gastineau, 2022).
- **Manufacturing**: Continuous manufacturing and biofabrication enable the production of complex biologics.
- **Commercialization**: Digital marketing and real-world health data analytics help target patients and healthcare professionals, while assessing real-world treatment effectiveness (Harvard Business Review, 2020; Champagne et al., 2020).

The growing use of digital platforms and targeted campaigns toward healthcare professionals illustrates the strategic importance of digital marketing in pharmaceutical commercialization (Bharskar & Siddheshwar, 2020).

Table 2: Scientific Advances and Their Impact on the Pharmaceutical Industry

Domain	Advances	Impact	Examples
Discovery	AI, ML, genomics, systems biology	Identification of new targets and design of effective drugs	Gene therapies, discovery of anticancer drugs
Development	Virtual clinical trials, 3D printing	Reduced time and costs, more precise testing	3D tissue models for trials
Manufacturing	Continuous manufacturing, biofabrication	More efficient production, complex biologic drugs	Continuous production lines, monoclonal antibodies
Commercialization	Digital marketing, real-world health data	Targeted outreach, real-world understanding of effectiveness	Targeted digital campaigns, patient outcome analysis

Source: Prepared by the author

2.3 Evolution of Business Models and Strategies in the Pharmaceutical Industry

The pharmaceutical industry has adapted its business models to cope with price pressures, competition, and regulatory changes:

- Diversification of portfolios and partnerships.
- Specialization in specific therapeutic areas.
- Development of generics, biologics, and personalized medicines.
- Investment in digital health.

These strategies have enabled companies to maintain competitiveness while meeting the demands of a complex and evolving market.

These customer-centric strategies influence healthcare professional relationship management and optimize field force engagement (Azeem et al., 2021; Kamath, 2021).

3. Contemporary Framework of the Pharmaceutical Industry

The global pharmaceutical industry is undergoing a profound transformation in the 21st century, shaped by scientific and technological advances, regulatory changes, and global economic dynamics. This evolution is particularly pronounced in emerging countries, including Morocco, where the sector is rapidly evolving.

a. Global Dynamics of the Pharmaceutical Industry

Scientific and technological innovations are revolutionizing the discovery, development, production, and marketing of medicines. Artificial intelligence, machine learning, genomics, systems biology, 3D printing, continuous manufacturing, and bio-manufacturing play a decisive role in this transformation (Nalbant & Aydın, 2023). At the same time, pharmaceutical companies are adapting their business models in response to pricing pressures, increased competition, and evolving regulations, focusing on diversification, specialization, the development of generics and biologics, as well as personalized and digital medicine.

The globalization of supply chains and the multiplication of mergers and acquisitions are reinforcing the sector's concentration, shaping a competitive landscape dominated by a few major players. However, access to safe, affordable, and high-quality medicines remains a critical challenge, particularly in developing countries.

b. Moroccan Specificities of the Pharmaceutical Industry

In Morocco, the pharmaceutical industry has experienced remarkable growth, shifting from primarily generic production toward greater diversification (El Moussali & Ouarraoui, 2022). Public policies have encouraged investment, innovation, and quality improvement, while seeking to position the country as a pharmaceutical hub in Africa.

The adoption of digital tools and interactive platforms for medical promotion in Morocco has transformed the relationship between pharmaceutical companies and healthcare professionals (Belahsen & Chakor, 2016).

Nevertheless, the Moroccan pharmaceutical sector faces several challenges, such as international competition, limited access to advanced technologies, and the need to develop highly skilled human resources. The determinants of pharmaceutical innovation in low- and middle-income countries, specifically in Morocco, highlight the importance of local R&D and policies encouraging innovation (Benali et al., 2021).Yet, these challenges are accompanied by significant opportunities, including Morocco's potential to become a major African pharmaceutical player contributing to improved population health.

3.1 Key Players and Influential Organizations in the Pharmaceutical Industry

The global pharmaceutical industry relies on a complex ecosystem involving various stakeholders engaged in the research, development, manufacturing, commercialization, and regulation of medicines.

The evolution of interactions between the industry and healthcare professionals reflects a global trend toward more strategic communications, integrating both digital channels and traditional approaches (Krendyukov & Nasy, 2020).

a. Pharmaceutical Companies. Multinational corporations such as Pfizer, Johnson & Johnson, Novartis, Roche, and Merck dominate the market with massive R&D investments and flagship products. In Morocco, companies like Sothema, Cooper Pharma, Delpharm Maroc, and Unipharm form the backbone of local production and distribution.

b. Regulatory Agencies. These institutions ensure the safety and efficacy of medicines. At the international level, the European Medicines Agency (EMA, Europe), Food and Drug Administration (FDA, United States), Pharmaceuticals and Medical Devices Agency (PMDA, Japan), and Agência Nacional de Vigilância Sanitária (ANVISA, Brazil) play a central role in regulating medicines and protecting public health. In Morocco, this function is carried out by the Moroccan Agency for Medicines and Health Products.

c. Research and Development Organizations (R&D). Universities, institutes, and research centers contribute to pharmaceutical innovation. For example, the National Institutes of Health (NIH, United States), Wellcome Trust, Max Planck Society, and Institut Pasteur are global references, while in Morocco, the National Oncology Center (CNO) contributes to biomedical research.

d. International Organizations. The WHO, the Global Fund, and the GAVI Alliance support access to medicines and the fight against priority diseases.

e. Professional Organizations. These bodies defend the interests of the sector and participate in shaping health policies, such as the International Federation of Pharmaceutical Manufacturers & Associations (IFPMA).

3.2 Current Trends and Future Perspectives of the Pharmaceutical Industry

The pharmaceutical industry is marked by constant evolution, influenced by scientific innovation, globalization, and public health imperatives.

Current Trends

- **Scientific and technological innovations:** AI, genomics, systems biology, 3D printing, and new therapies (immunotherapies, gene therapies) are revolutionizing practices.
- **Globalization and concentration:** The intensification of mergers and acquisitions is reshaping the competitive landscape.
- **Access to medicines:** Inequality of access remains a global challenge.
- **Evolving business models:** Diversification, specialization, generics, biologics, and digital medicine are becoming widespread.
- **Growing role of data:** Big data and AI are optimizing molecule discovery and clinical trials.
- **Consumer Engagement via Virtual Communities:** An emerging trend emphasizes the digital transformation of patient-industry interactions, highlighting how pharmaceutical companies connect with and involve patients through online platforms (Abbes & Rahmouni, 2021).

Future Perspectives

- **Personalized and precision medicine:** Treatments tailored to individual genetic profiles.
- **Prevention and health promotion:** Greater focus on vaccines and public health.
- **Digital technologies and connected health:** Digitization of medical practices and proactive health monitoring.
- **Collaboration and partnerships:** Increased cooperation between pharmaceutical players, academia, and NGOs.
- **Sustainability and social responsibility:** Reducing environmental impact and strengthening corporate societal commitments (Futura Health, 2023).

3.3 Challenges and Opportunities Facing the Pharmaceutical Industry

The pharmaceutical sector must address major challenges:

- **High R&D costs:** Developing new drugs remains lengthy, risky, and costly, limiting access to treatments (Espesson-Vergeat, 2021; Babei & Paché, 2020).
- **Regulatory and economic pressures:** Price controls, reimbursement constraints, and longer approval timelines (Farvaque, Garçon & Samson, 2022).

- **Antibiotic resistance:** A growing public health threat requiring new therapeutic classes.
- **Inequalities in access:** Exacerbated in developing countries by poverty and inadequate infrastructure.

At the same time, several opportunities reinforce the sector's potential:

- Scientific innovations paving the way for more effective treatments.
- Personalized and digital medicine improving clinical outcomes.
- Digital technologies facilitating medical monitoring and treatment management (Futura Health, 2023).
- Cross-sector collaboration promoting open research and data sharing.
- Sustainability and social responsibility strengthening companies' social legitimacy.

4. Societal and Economic Impacts of the Pharmaceutical Industry

The pharmaceutical industry is a major player in global health, combining research, development, production, and marketing of medicines. Its contributions to improving life expectancy, preventing and treating diseases, and reducing suffering are undeniable. At the same time, it occupies a central place in the global economy through job creation, stimulating innovation, and contributing to growth (Orabi & Bentaleb, 2020). However, its role also raises debates around access to treatment, high costs, regulatory challenges, and its influence on public health systems.

4.1 Influence of the Pharmaceutical Industry on Public Health Policies

Often perceived as a complex and opaque sector, the pharmaceutical industry exerts a profound influence on health policies and collective well-being.

a. A source of hope and improved health.

Massive investments in research and development have enabled major medical advances, particularly in the development of vaccines, antibiotics, and innovative treatments for chronic diseases. These achievements have contributed to increased life expectancy and a significant improvement in quality of life. Nevertheless, unequal access to the most recent, and often costly, treatments accentuates health disparities (Orabi & Bentaleb, 2020).

b. A powerful economic engine.

Beyond health, the industry represents a strategic sector of the global economy, generating millions of direct and indirect jobs. Its R&D investments fuel not only medical progress but also advancements in other scientific and technological fields, thereby strengthening cross-sectoral innovation and economic growth (Gautier, 2023).

c. Influence on health policies.

The financial and scientific weight of the industry gives it a leading role in setting health priorities, funding research, and regulating drug prices. While this influence supports innovation, it raises ethical concerns about the independence of public decision-making (Darouich & Dhiba, 2020).

d. A complex societal role.

Although the positive outcomes are undeniable, strict regulation remains necessary to ensure equitable access to medicines, promote independent research, and regulate pharmaceutical promotion (Orabi & Bentaleb, 2020).

e. A necessary dialogue.

Achieving a sustainable balance requires active cooperation between public authorities, the industry, healthcare professionals, researchers, and civil society. Transparent dialogue could reconcile pharmaceutical innovation with social equity.

4.2 Contribution of the Pharmaceutical Industry to the Global Economy

The pharmaceutical sector is a fundamental pillar of the global economy, contributing to growth, innovation, and employment. In 2021, R&D investments reached $130 billion, illustrating the strategic importance of this sector for scientific research (Gautier, 2023).

These investments not only foster the development of groundbreaking treatments but also generate

economic momentum, with approximately 36 million workers employed directly in the industry that same year. In addition, pharmaceutical activity stimulates innovation in other industrial sectors, promoting economic diversification and global competitiveness.

At the international level, pharmaceutical trade represents an essential share of global exchanges, strengthening the economic integration of nations. However, this economic power comes with a significant influence on public health policies, raising social and ethical concerns (Darouich & Dhiba, 2020).

4.3 Social and Ethical Implications of the Pharmaceutical Industry's Activities

Despite its undeniable contributions, the pharmaceutical industry lies at the center of several social and ethical controversies.

Access to medicines. High drug prices limit access for vulnerable populations, deepening health inequalities. Solutions such as price negotiations, the promotion of generics, and the establishment of solidarity-based financing mechanisms appear necessary.

Influence on public policies. The industry's economic power can steer research and public health priorities, often at the expense of neglected diseases (Darouich & Dhiba, 2020). Strengthening scientific independence and institutional transparency is essential.

Pharmaceutical advertising. Promotional practices and tools, including pharmaceutical detailing and non-personal promotion, can excessively influence medical prescriptions and directly affect physicians' prescribing behaviors, sometimes leading to inappropriate drug consumption. Stronger regulation and the promotion of rational prescribing are therefore recommended (Bimegdi, Belaiche & Ahid, 2023; Alowi & Kani, 2018; Hincapie et al., 2021; Kamarapu & Saritha, 2023).

Research and development. Animal experimentation raises ethical concerns regarding animal welfare and the validity of results transferable to humans. The development of alternatives and stricter ethical oversight are indispensable (Datta & Dave, 2017).

Innovation and patents. Patent regimes may restrict access to treatments in developing countries. Relaxing these rules, encouraging voluntary licensing, and promoting technology transfer are possible solutions to ensure equitable access.

Thus, the role of the pharmaceutical industry cannot be reduced solely to its economic or medical contributions. It must be analyzed holistically, considering its social, ethical, and political implications to ensure balanced governance centered on the public interest.

Conclusion

The pharmaceutical industry has undergone a profound transformation, evolving from artisanal apothecaries to a highly globalized and technology-driven sector. Its history reflects the interplay between scientific discoveries, industrial specialization, regulatory pressures, and global health demands (Chkirida, 2020). Advances in biotechnology, artificial intelligence, and digital health have reshaped drug discovery, development, manufacturing, and commercialization, while new business strategies—such as diversification, specialization, and investment in digital solutions—have enabled companies to adapt to an increasingly complex and competitive market (Khanna et al., 2020; Gastineau, 2022; Champagne et al., 2020).

Beyond its scientific and industrial achievements, the pharmaceutical sector plays a crucial role in public health and socioeconomic development, contributing to life expectancy, pandemic management, and innovation, while also facing persistent challenges including unequal access to medicines, high treatment costs, and ethical debates on the influence of lobbying and regulatory frameworks (Darouich & Dhiba, 2020; Bimegdi, Belaiche & Ahid, 2023). These tensions highlight the dual nature of the industry, which is simultaneously a driver of medical progress and a subject of societal scrutiny.

Ultimately, the temporal evolution of the pharmaceutical industry demonstrates that its sustainability depends not only on scientific and technological innovation but also on its ability to balance profitability with equity and accessibility. In this context, countries such as Morocco are called to strengthen their positioning within the global pharmaceutical landscape, by fostering innovation, supporting local production, and ensuring fair access to medicines. Such strategies will be decisive in addressing current and future health challenges while contributing to global health equity and economic development.

References

1. Abbes, Intissar, et Marwa Rahmouni. "Industrie pharmaceutique et communautés virtuelles des consommateurs : quel design pour ces nouvelles plateformes d'engagement du domaine de la santé ?" Innovations 66, no. 3 (2021): 177-202.
2. Alowi M, Kani Y (2018) Impact of Pharmaceutical Companies' Promotional Tools on Physicians' Prescription Patterns: A Systematic Review. J Appl Pharm 10: 267. doi: 10.4172/1920-4159.1000267
3. Azeem, Muhammad, Sania Aziz, Jawad Shahid, Aamir Hayat, Munir Ahmed, and Muhammad Khan. "The Impact of Customer-Centric Business Strategies on Customer Relationship Management: Pharmaceutical Field-Force Perspective." International Journal of Pharmaceutical and Healthcare Marketing (2021).
4. Babei, Jean, et Gilles Paché. "Usage des technologies numériques et création de valeur : une application au contexte de la logistique des produits médicaux." Vie & sciences de l'entreprise 209, no. 1 (2020): 133-157.
5. Belahsen, Adil, et Abdellatif Chakor. "Industrie pharmaceutique au Maroc : La promotion médicale à l'ère de l'outil digital." Revue Marocaine de Recherche en Management et Marketing, no. 14 (2016): 122-140.
6. Benali, Ilham, Nawfal Acha, et Hafid Barka. "Determinants of Pharmaceutical Innovation in Low and Middle-Income Countries: Empirical Study Conducted in Morocco." Revue Management & Innovation 3, no. 1 (2021): 137-156.
7. Bharskar, Ganesh, and Suhass Siddheshwar. "Digital Marketing in Pharmaceutical Sector." International Journal of Pharmaceutical Science and Health Care 2, no. 10 (2020). https://doi.org/10.26808/rs.ph.i10v2.01.
8. Bimegdi, Fatima Zahra, Abdelmajid Belaiche, et Samir Ahid. "Évaluation du prix des médicaments figurant sur les bulletins officiels au Maroc (2014–2019)." Annales Pharmaceutiques Françaises 81, no. 6 (2023): 1090-1098.
9. Champagne, David, Alex Devereson, Lucy Pérez, and David Saunders. Creating Value from Next Generation Real-World Evidence. McKinsey & Company, Life Sciences, 2020. https://www.mckinsey.com/industries/life-sciences/our-insights/creating-value-from-next-generation-real-world-evidence.
10. Chkirida, Brahim. 2020. "Le Système de Management Qualité en Industrie Pharmaceutique : Cas d'un Établissement Pharmaceutique Industriel Marocain." Thèse de doctorat, Université Mohammed V de Rabat, Faculté de Médecine et de Pharmacie, Rabat.
11. Coupevent, Marie. 2014. La Communication sur le Médicament : Histoire, (R)évolution et Perspectives des Stratégies de l'Industrie Pharmaceutique. Thèse de doctorat, Université d'Angers.
12. Darouich, Chaimaa, and Youssef Dhiba. "La gestion des risques de la chaine logistique pharmaceutique : Cas des entreprises pharmaceutiques marocaines." Revue de Management et Cultures, no. 5 (2020): 1-33.
13. Datta, Anusua, and Dhaval Dave. "Effects of Physician-directed Pharmaceutical Promotion on Prescription Behaviors: Longitudinal Evidence." Health Economics 26, no. 4 (2017): 450-468.
14. El Moussali, Mohammed Nabil, et Bouchra Ouarraoui. "Les apports du Nouveau Modèle de Développement pour la réforme du système de santé au Maroc : une analyse sur la base du cadre conceptuel des systèmes de santé." Dossiers de Recherches en Economie et Gestion : Dossier 10, no. 1 (2022): 11-29.
15. Espesson-Vergeat, Béatrice. "L'intelligence artificielle et la blockchain au service de la sécurisation logistique des produits dans le secteur pharmaceutique." Droit, Santé et Société 2, no. 2 (2021): 50-54.
16. Farvaque, Étienne, Hancito Garçon, and Anne-Laure Samson. "« Je Ne Tromperai Jamais Leur Confiance » : Analyse de l'Influence des Laboratoires sur la Relation Médecin-Patient en France." Revue d'Économie Politique 132, no. 2 (2022): 273-312.
17. Futura Health. "L'intelligence Artificielle Révolutionne la Découverte de Médicaments." 2023.

Disponible sur : https://www.bfmtv.com/tech/intelligence-artificielle/comment-l-ia- revolutionne-la-decouverte-des-medicaments-de-demain_AD-202312070187.html.
18. GASTINEAU, Orphélie. 2022. Impression 3D de médicaments : développement de nouvelles formes pharmaceutiques et personnalisation des traitements. Thèse de doctorat, Université Clermont Auvergne.
19. Gautier, Maxime. 2023. "Le marché pharmaceutique mondial – Fais et chiffres." Statista. Disponible sur : https://fr.statista.com/themes/3554/le-marche-pharmaceutique- mondial/#topicOverview.
20. Harvard Business Review. "The Pharmaceutical Industry Needs a Customer-Centric Digital Transformation." 2020. Disponible sur : https://hbr.org/sponsored/2020/09/the-pharmaceutical-industry-needs-a-customer-centric-digital-transformation.
21. Hincapie A, Schlosser E, Damachi U, Neff E, Llambi L, Groves K, et al. Perceptions of the provision of drug information, pharmaceutical detailing and engagement with non-personal promotion at a large physicians network: a mixed-methods study. BMJ Open. 2021;11(1)
22. Kamarapu , B. P., & Saritha, B. (2023). Analysis of Product Mix Variables Associated with Prescribing Behaviour of Doctors in Hyderabad, Telangana. Asian Journal of Economics, Business and Accounting, 23(17), 90–98.
23. Kamath, Madhusudhana. "Role of Information and Promotional Strategies for Indian Pharmaceutical Firms in the Age of Digital Marketing." EPRA International Journal of Research and Development (IJRD) 6, no. 3 (2021).
24. Khanna, Vaishali, Rakhi Ahuja, and Harvinder Popli. "Role of Artificial Intelligence in Pharmaceutical Marketing: A Comprehensive Review." Journal of Advanced Scientific Research 11, no. 3 (2020): 54-61.
25. Krendyukov, Andriy, and Dévi Nasy. "Evolving Communication with Healthcare Professionals in the Pharmaceutical Space: Current Trends and Future Perspectives." Pharmaceutical Medicine 34, no. 4 (2020): 247-256.
26. Nalbant, Kemal, and Sevgi Aydın. "Development and Transformation in Digital Marketing and Branding with Artificial Intelligence and Digital Technologies Dynamics in the Metaverse Universe." Journal of Metaverse 3 (2023): 9-18.
27. ORABI, Mounia, et BENTALEB, Chafik. "Bien-être au travail des cadres du secteur pharmaceutique au Maroc : Etude qualitative par entretiens semi-directifs." Revue Internationale des Sciences de Gestion 3, no. 2 (2020): 1028-1050.