

Leveraging Competitive Vigilance as a Strategic Approach to Enhancing Technological Innovation in the Algerian Pharmaceutical Firms : A Case Study of Biotic Unit of the Sidal Group

Mohamed Benbrahim¹, Dirar Abdelaziz Al-maaitah²

¹ University of Djilali Bounaama Khemis Miliana, Laboratory of Industry, Organizational Development of Enterprises and Innovation, m.benbrahim@univ-dbkm.dz

² Alburaimi University College Oman, derar_maaitah@yahoo.com

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Abstract: This study investigates the role of competitive vigilance in fostering technological innovation within Algerian pharmaceutical firms, with particular focus on the Biotic Unit of the Sidal Group. Adopting a descriptive-analytical approach, data were collected through a questionnaire administered to 41 managers and analyzed using SPSS (Version 25). The results reveal a strong, positive, and statistically significant relationship between competitive vigilance and both product and process innovation. The findings highlight competitive vigilance as a strategic driver of innovation that enables firms to anticipate environmental changes, enhance decision-making quality, and sustain competitive advantage within the dynamic pharmaceutical industry.

Keywords : Competitive Vigilance ; Technological Innovation ; Pharmaceutical Industry; Sidal Group ; Innovation Management.

JEL Classification Codes : O31, O32, M15, M10

1. INTRODUCTION

In light of ongoing economic transformations and the intensification of competitive pressures, firms are increasingly required to achieve high levels of performance to ensure survival and continuity within a complex and dynamic environment. Reliance on traditional resources alone is no longer sufficient to attain competitive excellence. Instead, technological innovation has emerged as a fundamental pillar for strengthening firms' competitive capabilities, particularly in knowledge-intensive sectors that depend heavily on research, development, and scientific advancement—most notably, the pharmaceutical industry.

Within this context, Algerian firms, especially those operating in the pharmaceutical sector, are striving to adopt modern strategic approaches grounded in the development of research and development (R&D) activities and the stimulation of technological creativity. Such efforts aim to enhance product quality and respond effectively to growing market demands. However, the achievement of these objectives remains contingent upon the extent to which these organizations are capable of anticipating environmental changes and adapting to them effectively. This requires the adoption of a continuous innovation-oriented culture that ensures responsiveness to customer needs while simultaneously reinforcing firms' innovative capabilities.

Given that organizations are open systems that continuously interact with their external environment, environmental scanning and analysis have become an indispensable strategic necessity. In this regard, the concept of competitive vigilance (competitive intelligence) has emerged as a key mechanism enabling firms to monitor environmental developments, track competitors' actions, anticipate opportunities, and mitigate potential threats. In doing so, it enhances organizational performance, supports decision-making processes, and contributes to the construction of sustainable competitive advantage.

Despite the growing body of literature addressing vigilance-related concepts, empirical studies focusing specifically on competitive vigilance as an independent variable influencing technological innovation within the Algerian pharmaceutical industry remain limited. This gap underscores the scientific relevance and originality of the present study.

Research Problem

In light of the above considerations, the central research problem of this study can be formulated as follows:

How does competitive vigilance influence the development of technological innovation in pharmaceutical firms?

Accordingly, this study aims to analyze and measure the role of competitive vigilance in supporting technological innovation within Algerian pharmaceutical companies. To address this research problem, the following hypotheses are proposed:

Main hypothesis: Competitive vigilance has a statistically significant effect on the development of technological innovation in pharmaceutical firms.

Sub-hypotheses:

- Competitive vigilance has a statistically significant positive effect on enhancing product innovation in pharmaceutical firms.

- Competitive vigilance has a statistically significant positive effect on improving production process innovation in pharmaceutical firms.

Review of Previous Studies

A number of studies have examined competitive vigilance and its relationship with performance and innovation. The most relevant contributions are summarized below:

- **Chen Fu & Qiuchen Chen (2025)**, in their article “The Future of Pharmaceuticals : Artificial Intelligence in Drug Discovery and Development”, analyzed the role of intelligent technologies—particularly artificial intelligence, data analytics, and information processing—in fostering innovation within the pharmaceutical industry, especially in R&D activities. Using a theoretical and applied analytical approach, the study investigated AI applications in pharmaceutical product development. The findings indicated that the use of data and intelligent analytics significantly accelerates technological innovation and enhances the efficiency of pharmaceutical development. This study aligns with the present research in its treatment of technological innovation as a dependent variable, while differing in its independent variable focus.
- **Manuchehr Bashirynejad et al. (2024)**, in their article “Trends Analysis and Future Study of the Pharmaceutical Industry Field : A Scoping Review”, examined emerging trends and the future outlook of the pharmaceutical industry through a scoping review of the literature. The study focused on technological and innovative developments, particularly in R&D and digital transformation. The authors concluded that technological innovation is a critical determinant of pharmaceutical firms’ competitiveness. However, this study differs from the present one in that it is purely conceptual and does not employ field data, nor does it directly address competitive vigilance. Nevertheless, it provides a useful framework for understanding the competitive environment of pharmaceutical firms.
- **Azamou & Gaddash (2022)**, in their article “The Role of Technological Vigilance in Supporting Technological Innovation in Economic Enterprises: A Case Study of Condor Company”, investigated the contribution of technological vigilance to the enhancement of technological innovation. The study adopted a descriptive-analytical approach using a 45-item questionnaire administered to a sample of 50 managers and executives. Data were analyzed using SPSS. The results revealed a statistically significant impact of technological vigilance on the dimensions of technological innovation. This study is similar to the present research in examining the relationship between vigilance and innovation ; however, it focuses on technological vigilance rather than competitive vigilance.
- **Aïchouch (2022)**, in the article “*Strategic Vigilance as an Approach to Promoting Technological Innovation : A Case Study of the TPL Industrial Group in El Oued Province*”, explored the role of strategic vigilance in fostering technological innovation. The study relied on a descriptive-analytical methodology using a questionnaire distributed to a sample of 50 managers and supervisors, with data analyzed using SPSS. The findings indicated a statistically significant relationship between strategic vigilance and both incremental and radical technological innovation. While this study also addresses the vigilance–innovation relationship, it employs strategic vigilance as a broader construct, whereas the present research focuses specifically on competitive vigilance.

Research Gap and Study Contribution

The review of prior studies indicates a growing scholarly interest in examining the

relationship between vigilance in its various forms and innovation. However, most existing research has primarily focused on technological vigilance, while empirical studies investigating the impact of competitive vigilance on technological innovation within the pharmaceutical sector remain scarce. This represents a clear research gap, particularly in the Algerian context.

Accordingly, the present study seeks to address this gap by empirically examining the effect of competitive vigilance on technological innovation in Algerian pharmaceutical firms. Its originality lies in positioning competitive vigilance as a strategic driver of innovation within the pharmaceutical industry.

Scientific Contribution

The scientific contribution of this study lies in highlighting the impact of competitive vigilance as a strategic determinant of technological innovation within the Algerian pharmaceutical sector. By providing empirical evidence from an Algerian pharmaceutical firm, the study contributes to enriching the Arabic and international literature on the relationship between competitive vigilance and technological innovation in organizational contexts.

II. Conceptual Framework of the Study Variables

The continuous fluctuations of the business environment and the increasing complexity of challenges facing organizations have highlighted the critical role of creative thinking in ensuring continuity and growth within turbulent business settings. Firms are now required to effectively manage emerging changes in order to enhance performance and sustain continuous development. This, in turn, necessitates the design of advanced systems and mechanisms for continuous environmental scanning and monitoring—an approach commonly referred to as the “vigilant organization,” particularly in the context of the contemporary technological and knowledge-driven explosion. In such an environment, firms are compelled to remain permanently alert and more innovative than their competitors. Despite the growing body of literature on vigilance and innovation, both concepts remain partially ambiguous, a gap that this section seeks to clarify.

II.1. The Nature of Competitive Vigilance

With the intensification of competition, the rapid development of information and communication technologies, and the increasing abundance of data, organizations have become compelled to adopt new approaches to anticipate environmental changes. Among the most prominent of these approaches is strategic vigilance in its various dimensions, which ensures that decision-makers have access to timely and relevant information. Accordingly, firms continuously monitor and analyze their competitive environment by tracking competitors’ activities. Competitive intelligence enables the identification of the most threatening rivals, as well as an understanding of their strategies, thereby facilitating appropriate managerial decision-making.

First: Competitive Vigilance

Among the most influential definitions of competitive vigilance are the following:

- H. Lesca defines competitive vigilance as the firm’s “radar,” enabling it to anticipate changes in the competitive environment, identify emerging opportunities, and

reduce risks associated with uncertainty (Al-Nu'as, 2013, p. 261).

- Patreiron (1994) describes it as an informational process through which data about the competitive environment are collected from multiple sources and transformed into useful information. This enables firms to identify current and potential competitors, as well as the forces affecting their competitive position. It also involves monitoring competitors' capabilities, strengths, and current and future performance (Patreiron, 1994, p. 19).

- It is also defined as an activity through which organizations gain an understanding of competitors' behavior, performance, capabilities, strategies, objectives, and underlying assumptions, as well as anticipate their future actions through the systematic collection and analysis of quantitative and qualitative data to support decision-making (Qoujil, 2012, p. 77).

From the above definitions, competitive vigilance can be understood as a systematic process of collecting and analyzing information related to competitors—including their capabilities, products, strategies, technologies, and patents—in order to anticipate environmental changes and support strategic decision-making aimed at strengthening the firm's competitiveness.

Second: Fields of Competitive Vigilance

Competitive vigilance, also referred to as *competitive intelligence*, places the organization in a continuous state of monitoring and observation of its environment. This enables firms to identify both current and potential competitors, determine their strengths and weaknesses, and formulate appropriate strategies and decisions that support product development and enhance competitive capabilities. Therefore, organizations must strengthen the main competitive domains that constitute the core fields of competitive vigilance, which can be summarized as follows: (Al-Aydani, 2017, p. 138).

A. Identification of current competitors:

This involves collecting information based on Porter's framework, including competitors' capabilities, strategies, new objectives, resources, and anticipated decisions.

B. Identification of potential competitors:

Competitive vigilance is not limited to existing rivals but also includes potential entrants who may threaten market positions. These entrants often exploit their capabilities and resources to gain market share; therefore, firms must monitor them as closely as existing competitors.

In addition, competitive vigilance focuses on collecting information on several key aspects (Sahnoun, 2017, p. 45) :

1. **Competitors' products:** product range, market segments served, and market share.
2. **Sales and distributions techniques :** distribution networks, pricing strategies, and marketing channels.
3. **Partners:** suppliers, contractors, and external stakeholders.
4. **Production systems:** production methods, resources, competencies, and cost structures.
5. **Research and development:** technologies used and registered patents.

C. Substitute products:

Substitute goods and services represent a significant competitive threat, as they may satisfy the same customer needs at lower cost or higher quality. Therefore, firms must closely monitor potential substitutes.

Third: Importance and Objectives of Competitive Vigilance

A. Importance of Competitive Vigilance

Based on the above definitions, the importance of competitive vigilance lies primarily in enabling firms to continuously monitor and analyze their competitive environment and rivals. Its significance is further reflected in the following aspects (Berkani, 2015, p. 224):

1. Equipping firms with tools and methodologies for competitive environment analysis and cost reduction.
2. Enhancing organizational alertness and listening capabilities, leading to stronger market positioning.
3. Providing insights into competitors' prices, sales volumes, market share, financial performance, profits, and return on investment.
4. Identifying competitors' strengths and weaknesses, as well as associated opportunities and threats.
5. Enabling firms to establish entry barriers to protect their market position through economies of scale, product differentiation, and absolute cost advantage.
6. Supporting continuous monitoring of environmental changes.
7. Leveraging competitors' experiences by analyzing their successes and failures through benchmarking systems.

B. Objectives of Competitive Vigilance

Organizations adopt effective competitive vigilance systems in response to increasing environmental turbulence in order to strengthen their competitive advantages. By exploiting weak signals, firms can anticipate competitors' behavior and identify "blue ocean" opportunities within highly competitive "red ocean" markets. Key objectives include (Allawa, 2017, p. 210):

1. Anticipating market fluctuations and competitors' movements.
2. Improving organizational competitive performance and the quality of offerings.
3. Capturing emerging opportunities and achieving sustainable competitive advantage.
4. Facing intense market competition.
5. Fostering innovation and introducing new products to sustain long-term competitiveness.
6. Developing effective distribution channels and shortening product life cycles.
7. Enhancing organizational flexibility and responsiveness to both explicit and latent customer needs.
8. Supporting safer and more informed decision-making processes.

II.2. The Nature of Technological Innovation

Technological innovation represents one of the most significant forms of innovation, if not the most important. Therefore, it is essential to examine key definitions of innovation in general.

First: Definition of Innovation

Innovation has been defined in multiple ways depending on researchers' perspectives and theoretical approaches. One of the most widely adopted definitions is that of the OECD, which describes innovation as the set of scientific, technical, commercial, and financial steps necessary for the successful development and market introduction of new or improved industrial products, as well as the commercial application of new or improved methods, processes, or equipment, or the introduction of new social service methods. Research and development is considered only one stage within this broader process (Mohamed Naïf & Haji Anmar, 2011, p. 11).

From this perspective, innovation can be defined as the introduction of new products or services, new production methods, or improvements in administrative and organizational processes. Innovation progresses through several stages, from invention to development, experimental production, and finally commercialization. Invention refers to the generation of new ideas or solutions to previously unsolved problems, whereas innovation refers to the practical application of these ideas and their transformation into tangible outcomes.

Second: Technological Innovation—Nature and Characteristics

Economic theories have significantly contributed to accelerating technological development and fostering innovation, generating extensive discussions in fields such as strategic management. Technological innovation is understood as the embodiment and improvement of technological products or processes that lead to substantial enhancements in performance and efficiency.

Its implementation relies on the integration of three key pillars:

- **Databases**, as strategic knowledge resources;
- **Human capabilities**, representing intellectual and skill-based capital;
- **Financial resources**, which support the development and implementation of innovations.

Thus, technological innovation is not limited to a technical dimension but rather represents the outcome of an integrated system combining knowledge, human, and financial resources within a coherent strategic and organizational framework (Chan et al., 2018). It is characterized by two fundamental components : technological content and creative attributes. It is also important to note the existence of various classifications of innovation.

A. Types of Innovation

Traditionally, innovation has been classified into four types (Al-Ayashi, 2017, p. 103): incremental innovation, technical innovation, social innovation, and radical innovation (Hoholm et al., 2018). This classification can be summarized as follows:

Figure 01 : Traditional Classification of Innovation

Product Perception (Technological Development)		
Consumer Perception (Perceptual Development)	Weak Consumer Perception (Perceptual Change)	Strong Consumer Perception (Perceptual Change)
Strong Product Perception (Technological Change)	Technical Innovation (<i>Modification in the internal structure</i>)	Radical Innovation (<i>Complete transformation</i>)
Weak Product Perception (Technological Change)	Incremental Innovation	Social Innovation (<i>Modification in applications</i>)

Source : Adapted from Ayyashi Zarzour (2017), *previous reference*, p. 106.

However, the most widely accepted classification of innovation divides it into two main types (Daft, 2000, p. 21).

- **Administrative or organizational innovation** : involves changes in organizational structure and the introduction of new managerial models that enhance flexibility and operational efficiency.
- **Technological or technical innovation** : which will be discussed in detail in the following section.

B. Concept of Technological Innovation

The U.S. National Science Foundation defines technological innovation as the introduction or improvement of products, processes, or services in the market. It may take one of the following forms (Aqli & Nasser, 2012, p. 161). entirely new products, improved existing products, entirely new processes, improved processes, or new services (though some studies exclude the latter form).

The OECD also defines it as the introduction of new products or production methods, as well as technological improvements to existing products (Aïchouch, 2022, p. 356). Accordingly, technological innovation can be defined as a set of scientific and technical activities aimed at developing new products, improving existing ones, enhancing production methods, or introducing new processes to the market, thereby ensuring first-mover advantages in industrial sectors.

Third: Importance and Characteristics of Technological Innovation

A. Importance of Technological Innovation

The importance of technological innovation is reflected in the following (Mahmoud Abbas, 2010, p. 254):

- Improving customer service through flexibility and responsiveness to customer needs.
- Enhancing competitiveness by accelerating product introduction and improving production processes.
- Increasing productivity and performance efficiency while optimizing resource and energy use, thereby boosting sales and profits.
- Creating a favorable work environment for the development of new products and processes that satisfy customer needs.
- Achieving strategic objectives related to excellence, survival, and growth.

It also enables firms to :

- Face intense market competition by adopting innovative solutions despite associated risks (El-Rahim & Hussein, 2008, p. 63).
- Keep pace with rapid developments in information technology, which contribute to improvements in both goods and services.

B. Characteristics of Technological Innovation

Technological innovation is distinguished by the following characteristics (Asaad Nour, 2011, p. 22).

- It is the result of the application of established technological knowledge; innovations based on inaccurate information cannot be considered technological.
- It is closely linked to production and productivity improvements.
- It does not necessarily require wide market diffusion, although competitiveness depends on its effectiveness.

Fourth: Types of Technological Innovation

Technological innovation can be classified into two main types : process innovation and

product innovation (Diaconu, 2011, p. 133).

A. Process Innovation

Process innovation refers to the development of new production processes or the improvement of existing ones to meet customer needs. It involves introducing new production technologies within the firm and is generally less tangible than product innovation.

It can be further divided into:

1. Design of a new production process :

Defined as the systematic organization and configuration of workforce, resources, and equipment required for production operations. At the strategic level, it involves designing operational networks through which customers receive goods and services. At the operational level, it focuses on organizing technology, people, and processes. (Al-Rahim & Hussein, 2008, p. 69)

2. Improvement of existing processes:

Defined by Krajewski & Ritzman as the enhancement of procedures, activities, methods, and production system performance through systematic analysis (Qasem, 2021, p. 24).

B. Product Innovation

Product innovation refers to introducing new products or improving existing ones. It includes tangible outputs perceived by customers and may range from incremental improvements to radical innovation (Henderson & Clark, 1990 ; Henderson, 2021, p. 2).

It takes two main forms:

- **New product development:** generating new ideas that add commercial and functional value, often derived from marketing research and R&D activities.
- **Improvement of existing products:** enhancing product features, branding, or functionality to prevent obsolescence and maintain market competitiveness (Kotler & Armstrong ; Rashid Al-Barwari & Al-Naqshbandi, 2013, p. 113).

III. Empirical Framework of the Study : Methodology and Tools

Following the presentation of the theoretical framework, this section turns to the empirical investigation of the study in order to test the research hypotheses in the field.

III.1. Population and Sample of the Study

The study was conducted within the Biotic production unit of the Saidal Group, and targeted a sample of its administrative executives. The data collection process relied on a structured questionnaire administered over a defined time period.

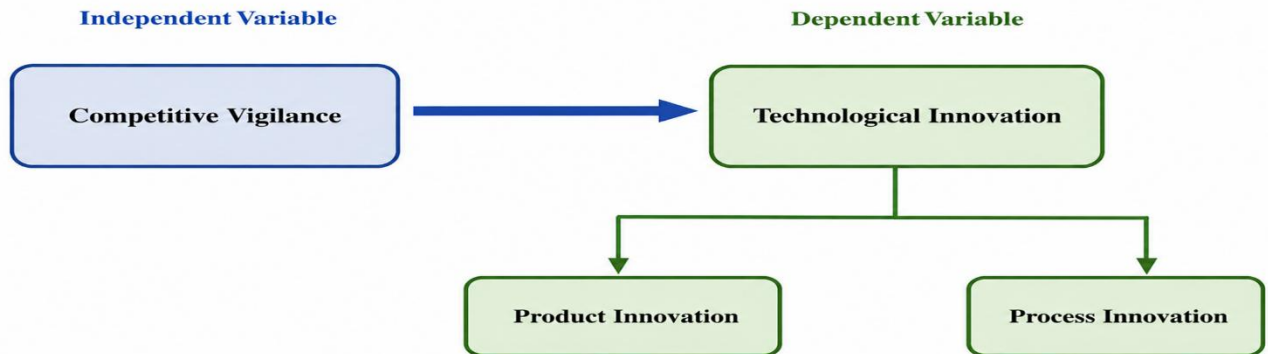
Accordingly, the study population was limited to the administrative staff of the production unit located in Harrach (Biotic Unit), which is part of the Saïdal Group operating in the pharmaceutical industry. This contextual limitation may reduce the generalizability of the findings of the findings to the entire Algerian pharmaceutical sector.

Data were collected through a questionnaire distributed to a sample of 41 administrative staff members. Although the sample size is relatively limited, it is considered acceptable given the small number of executives within the studied unit. All distributed questionnaires were retrieved and deemed valid for statistical analysis. The data were subsequently coded and analyzed using the Statistical Package for Social Sciences (SPSS), version 25.

Research Model : The conceptual model of the study illustrates the relationship between the independent variable—competitive vigilance—and the dependent variable—technological innovation, which is measured through two dimensions : product innovation and production process innovation. The study assumes a positive effect of competitive vigilance on enhancing

technological innovation within pharmaceutical organizations.

Figure 02: Research Model



Source: Prepared by the researchers based on the literature and previous studies.

III.2. Study Instrument

Based on the theoretical framework and relevant prior studies, and in order to answer the research problem and hypotheses, a structured questionnaire was developed. The instrument consisted of 20 items distributed across three dimensions :

- Competitive vigilance dimension (importance and outcomes): 11 items
- Technological innovation in products: 5 items
- Technological innovation in production processes: 4 items

The study adopted a five-point Likert scale (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree). The class width was calculated as follows: $(5-1) / 5 = 0.8$

Thus, the response categories were classified as follows:

Table 01 : Five-Point Likert Scale Measurement Levels

Response category	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Weighted mean	1.00–1.79	1.80–2.59	2.60–3.39	3.40–4.19	4.20–5.00

Source : Prepared by the researchers.

III.3. Statistical Methods of Analysis

To test the study hypotheses, the researchers used SPSS (version 25) and applied several statistical techniques, including:

- Reliability analysis (Cronbach's Alpha)
- Descriptive statistics (means and standard deviations)
- Correlation and determination coefficients
- Simple linear regression analysis
- One-way ANOVA for statistical differences.

III.3.1. Validity and Reliability of the Questionnaire

First - Face Validity : The questionnaire was reviewed by a panel of academic experts in the field to ensure clarity, relevance, and appropriateness. Based on their feedback, the

instrument was finalized in its final form.

Second- Reliability Analysis : Internal consistency was assessed using **Cronbach's Alpha coefficient** to measure the reliability of the three dimensions of the questionnaire. The results are presented in the following table :

Table 02 : Reliability (Cronbach's Alpha) Results for Questionnaire Dimensions

No.	Dimension	Number of Items	Cronbach's Alpha
1	Competitive vigilance	11	0.84
2	Product innovation	5	0.91
3	Production process innovation	4	0.90
—	Overall questionnaire reliability	20	0.89

Source: Prepared by the researchers based on SPSS V25 outputs.

The results indicate a high level of internal consistency, as all coefficients are close to 1. This confirms that the questionnaire is highly reliable and suitable for empirical analysis. The first dimension recorded a reliability value of 0.84, while the second reached 0.91, indicating strong measurement stability.

III.4. Analysis of Study Results

First : Descriptive Analysis of Study Dimensions

This section presents the descriptive analysis of the questionnaire items using arithmetic means and standard deviations, as shown in the following tables.

Table 03: Means and Standard Deviations for Competitive Vigilance

Items	Mean	Std. Dev.	Agreement Level	Rank
The organization considers the existence of a competitive vigilance unit essential within its structure	4.01	1.03	Agree	1
The organization seeks to understand competitors' capabilities and predict their decisions	3.89	0.88	Agree	2
Competitors' information is considered a strategic resource as important as other organizational resources	3.70	1.04	Agree	5
The organization continuously monitors competitors' movements, strategies, and objectives	3.67	1.10	Agree	6
The organization continuously updates knowledge about competitors' products and services	3.64	1.08	Agree	8
Competitive vigilance contributes to capturing opportunities overlooked by competitors	3.66	1.08	Agree	7
Competitive vigilance enables monitoring of competitors' alliances and customer structures	3.72	1.08	Agree	3
Competitive vigilance is associated with identifying threats and opportunities for decision-making	3.60	1.10	Agree	10
Competitive vigilance contributes to developing employee competencies and knowledge sharing	3.71	0.96	Agree	4
The organization uses modern technologies to enhance vigilance effectiveness	3.50	1.02	Agree	11
Competitive vigilance protects the organization from competitors' threats and misinformation	3.61	1.17	Agree	9
Overall mean (Competitive Vigilance)	3.70	0.72	Agree	—

Source : Prepared by the researchers based on SPSS V25 outputs.

The results show that respondents generally agreed on the importance and presence of

competitive vigilance practices, with an overall mean of 3.70. The highest-rated item (mean = 4.01) indicates strong recognition of the importance of establishing a vigilance unit. The lowest-rated item (mean = 3.50) suggests some limitations in technological infrastructure and supporting tools.

Overall, these results indicate a relatively high level of competitive vigilance within the organization, despite certain operational constraints.

Table 04: Means and Standard Deviations for Technological Innovation

Product Innovation

Items	Mean	Std. Dev.	Agreement
Technological innovation in products is a core organizational strategy	3.83	1.10	Agree
The organization provides resources for R&D and idea development	3.55	1.06	Agree
The organization develops new components to improve product quality	3.68	1.08	Agree
Products are continuously updated according to customer needs	3.62	1.08	Agree
The organization cooperates with foreign expertise to develop new products	3.78	1.08	Agree
Product innovation index mean	3.69	0.84	Agree

Process Innovation

Items	Mean	Std. Dev.	Agreement
Process innovation is a core part of organizational strategy	3.46	1.11	Agree
The organization adopts modern technologies to improve processes	3.55	1.03	Agree
The organization updates maintenance systems and technologies	3.64	0.92	Agree
The organization collaborates with firms to improve production processes	3.60	1.20	Agree
Process innovation index mean	3.56	0.86	Agree
Overall technological innovation mean	3.62	0.85	Agree

Source : Prepared by the researchers based on SPSS V25 outputs.

The results indicate a generally positive level of technological innovation (mean = 3.62).

Product innovation scored slightly higher than process innovation, suggesting that firms place relatively more emphasis on product development than on production system transformation.

III.5. Hypothesis Testing and Results Interpretation

First Sub-Hypothesis : Competitive vigilance has a statistically significant positive effect on product innovation in pharmaceutical firms.

The results of the simple linear regression are presented in Table 05:

Table 05: Simple Regression Results for Product Innovation

Variable	Correlation (R)	F-test	R ²	T-test	Model Equation
Competitive vigilance	0.86	138.45	0.74	11.76	$Y = 0.24 + 0.86X$

All significance values = 0.000

Source: Prepared by the researchers based on SPSS V25 outputs.

The results show a strong positive correlation ($R = 0.86$), indicating that higher levels of competitive vigilance are associated with higher levels of product innovation. The model is

statistically significant ($F = 138.45$, $p < 0.05$), and the coefficient of determination ($R^2 = 0.74$) indicates that competitive vigilance explains 74% of the variation in product innovation.

Second Sub-Hypothesis : Competitive vigilance has a statistically significant positive effect on production process innovation.

Table 06: Simple Regression Results for Process Innovation

Variable	Correlation (R)	F-test	R ²	T-test	Model Equation
Competitive vigilance	0.88	185.18	0.78	12.67	$Y = 0.22 + 0.89X$

All significance values = 0.000

Source: Prepared by the researchers based on SPSS V25 outputs.

The results reveal a strong positive relationship ($R = 0.88$). The model is statistically significant ($F = 185.18$), and competitive vigilance explains 78% of the variance in process innovation.

Main Hypothesis : Competitive vigilance has a statistically significant effect on technological innovation in pharmaceutical firms.

Table 07: Simple Regression Results for Overall Technological Innovation

Variable	Correlation (R)	F-test	R ²	T-test	Model Equation
Competitive vigilance	0.91	197.78	0.83	15.22	$Y = 0.18 + 0.90X$

All significance values = 0.000

Source: Prepared by the researchers based on SPSS V25 outputs.

The findings confirm a very strong positive relationship ($R = 0.91$) between competitive vigilance and technological innovation. The model is statistically significant ($F = 197.78$), and $R^2 = 0.83$ indicates that competitive vigilance explains 83% of the variance in technological innovation.

Overall, the results support the main hypothesis and confirm that competitive vigilance plays a decisive role in enhancing technological innovation within pharmaceutical firms. This can be explained by the fact that competitive vigilance reduces environmental uncertainty and improves the quality of strategic information, thereby positively influencing innovation-related decisions, particularly in knowledge-intensive sectors such as the pharmaceutical industry.

IV. Conclusion

In line with the theoretical framework, which examined the role of competitive vigilance in fostering technological innovation, and the empirical investigation conducted within the Biotic production unit of the Saïdal Group, the study has reached a set of key findings, the most important of which are summarized below:

- Competitive vigilance constitutes an integrated information system encompassing all processes and activities that enable the organization to monitor, search for, process, analyze, and disseminate competitive information. This information is subsequently used to support decision-making processes at various organizational levels and to achieve innovation and technological leadership.
- Innovation is a continuous and cyclical process that ensures the alignment of the organization's products and services with evolving market demands and changing customer needs.

- The Biotic production unit demonstrates a strong interest in both competitive vigilance and technological innovation, reflecting their strategic importance within the organization.
- There is a strong positive effect of competitive vigilance on product innovation, as indicated by the coefficient of determination ($R^2 = 0.74$), meaning that 74% of the variation in product innovation is explained by competitive vigilance.
- There is also a strong positive effect of competitive vigilance on production process innovation, where the coefficient of determination ($R^2 = 0.78$) indicates that 78% of the variation in process innovation is attributable to competitive vigilance.
- Competitive vigilance has a significant overall impact on technological innovation in pharmaceutical firms, with $R^2 = 0.83$, meaning that 83% of the variation in technological innovation is explained by competitive vigilance. This relatively high explanatory power highlights the critical role of activating competitive vigilance in enhancing technological innovation within the studied organization.

These findings are consistent with the study conducted by **Azzamou & Gaddash**, which confirms that competitive vigilance represents an effective strategic tool for supporting technological innovation. It is not merely an informational mechanism, but rather a strategic capability that contributes to achieving technological leadership, particularly in knowledge-intensive sectors such as the pharmaceutical industry. This underscores the necessity of integrating competitive vigilance into the strategic policies of Algerian enterprises.

Recommendations

Based on the results obtained, the study proposes the following recommendations:

- The necessity of establishing a formal and effective competitive vigilance system that ensures access to critical information, thereby strengthening innovation and competitive advantage.
- Supporting research and development activities and strengthening linkages with higher education institutions, research centers, and foreign expertise through strategic partnerships, in order to bridge existing gaps and enhance access to innovative ideas.
- Designing training and motivation programs aimed at enhancing employee competencies, improving vigilance capabilities, and fostering a culture of innovation within the organization.
- Updating and modernizing incentive systems to retain human capital and encourage internal competition that contributes to technological innovation development.
- Promoting coordination and collaboration among different departments and organizational levels to improve production processes, facilitate communication, and ensure efficient knowledge sharing rather than information hoarding.

- **Future Research Perspectives**

Finally, this study opens several avenues for future research. It is recommended that future studies expand the scope of analysis to include other pharmaceutical firms in order to enhance the generalizability of findings. It would also be valuable to investigate the impact of other dimensions of strategic vigilance, such as technological vigilance and environmental vigilance, on organizational and digital innovation.

Furthermore, future research could benefit from larger sample sizes and the application of more advanced statistical techniques, such as structural equation modeling (SEM), in order to provide deeper insights and improve the robustness and external validity of the results.

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