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Impact of Absorptive Capacity on Innovation: The Mediating Role of Organisational Learning

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ABSTRACT

The Nigerian pharmaceutical industry, like many other sectors in the country, has been grappling with the challenge of optimal performance. Despite the industry's significant role in the nation's healthcare delivery system, it faces several challenges in achieving optimal performance. Hence, this study investigates organizational learning as a mediator of the impact of absorptive capacity on innovation. Specific objectives are to investigate the impact of research and development intensity on product innovation, assess the influence of employee training and development on organizational innovation and investigate the impact of knowledge management practices on process innovation. A descriptive research design with a population of 431 staff of the Tuyil pharmaceutical factory was used. A sample size of 207 was obtained using the Taro Yamane formula. Hypotheses were tested using Structural Equation Modelling (SEM) with the aid of SmartPLS 3. The findings show that the relationship between research and development intensity, employee training and development and organizational learning mediates the relationship between knowledge management practices and product innovation, organizational innovation, process innovation and innovation are statistically significant, respectively, with R^2s of 66.0%, 67.1%, 52.7% and 58.4% as mediator impact and 65.9% as overall impact. The study concluded that organizational learning mediates the effect of absorptive capacity on innovation in a positively significant manner at the Tuyil Pharmaceutical factory.

1. Introduction

In today's fast-changing world, businesses must constantly innovate to stay relevant and competitive. Innovation allows organizations to create new products, improve processes, and find better ways to meet market demands. It is a key factor in ensuring long-term success, especially in industries where technological advancements and competition are intense. A company's ability to innovate depends on many factors, including its absorptive capacity. Absorptive capacity refers to how well an organization can

recognize, acquire, understand, and use knowledge from external sources. This concept is particularly important in industries like pharmaceuticals, where staying ahead requires continuous learning and adaptation. However, the link between absorptive capacity and innovation is complex, as it often involves other factors such as organizational learning.

Absorptive capacity, a multifaceted concept, refers to an organization's capability to recognize, acquire, integrate, transform, and utilize external knowledge (Todorova & Durisin, 2017). This capacity plays a pivotal role in enhancing a firm's innovative output by enabling it to leverage external knowledge and combine it with internal expertise to create novel products, services, or methods. Nevertheless, the connection between absorptive capacity and innovation is not straightforward, as it is influenced by various organizational dynamics, including the process of organizational learning. Absorptive capacity is especially crucial in knowledge-intensive sectors such as technology, biotechnology, and pharmaceuticals, where innovation depends heavily on external knowledge flows and rapid technological advancements (Tsai, 2020). In these industries, the ability to integrate and utilize external insights significantly influences a firm's ability to maintain a competitive edge. Organizations that effectively build their absorptive capacity are better positioned to address technological disruptions and adapt to changing market dynamics, thereby gaining a competitive advantage.

Innovation can be defined as the application of creative ideas that lead to the introduction of new goods or services or improvements to existing offerings. Recent studies, such as those by Kessler and Gopalakrishnan (2018), highlight that the success of innovation increasingly relies on a company's ability to manage knowledge effectively. Enhancing systems for acquiring, learning, and assimilating knowledge has become critical for businesses to maintain competitiveness in today's marketplace. To craft effective innovation strategies, firms must not only absorb information from their external environment but also ensure its effective utilization internally.

Innovation can be classified into various types, including product, process, organizational, and marketing innovations (Schumpeter, 2017). Product innovation involves the creation of new or improved goods and services, while process innovation focuses on improving methods of production or delivery. Organizational innovation pertains to changes in operational practices, workplace structures, or external relationships, whereas marketing innovation involves introducing novel strategies in areas such as promotion, pricing, or distribution. Although each type serves a distinct function, they collectively strengthen an organization's ability to adapt and prosper in an ever-changing environment (Dodgson et al., 2014).

Organizational learning serves as a foundational pillar for innovation by enabling the systematic acquisition, interpretation, and dissemination of knowledge within a company. When organizations cultivate a culture centered on continuous learning and open knowledge sharing, they amplify their capability to recognize, internalize, and effectively utilize external knowledge. This approach significantly strengthens their absorptive capacity, unlocking greater innovation potential (Jerez Gomez, 2015).
The role of absorptive capacity is particularly pronounced in industries like pharmaceuticals, where innovation is heavily reliant on knowledge integration. In Nigeria, companies such as Tuyil Pharmaceutical have demonstrated how robust absorptive capacity can profoundly influence their innovation strategies, especially over the past two decades. The increasing emphasis on Knowledge Management (KM) within both academic and industrial domains reflects its critical importance in helping organizations maintain a competitive edge in today's dynamic technological landscape (Reece & Sheun, 2015).

The Nigerian pharmaceutical sector faces challenges in achieving optimal performance despite its critical role in the healthcare system. Globally recognized for its research intensity, the industry struggles with a "productivity paradox," where increased R&D spending has not yielded proportionate product launches due to strict regulations and higher operational costs. In Nigeria, innovation is vital for addressing

local health issues and staying competitive, but limited absorptive capacity—essential for leveraging external knowledge to drive innovation—remains underexplored. Key challenges include limited access to advanced technologies, regulatory hurdles, and skill shortages, making it difficult for firms to adopt innovative strategies.

Research Objective

The aim of this study is to ascertain the impact of absorptive capacity on innovation and the role played by organizational learning in this relationship. However, for the successful completion of the study, the following sub-objective are put forward;

i. Investigate the impact of research and development intensity on product innovation.
ii. Access the influence of employee training and development on organisational innovation.
iii. Investigate the impact of knowledge management practices on process innovation.

Research Hypothesis

The following hypotheses are formulated to guide the study at 5% significance level:

H_1: Research and development intensity does not influence product innovation.
H_2: Employee and development do not have an impact on organisational innovation.
H_3: Knowledge management practices do not significantly influence process innovation.

2. Literature Review

Absorptive capacity

Absorptive capacity, introduced by Cohen and Levinthal (1990), refers to an organization's ability to recognize, assimilate, and apply external knowledge to drive innovation and maintain competitiveness (Aljanabi, 2020; Dezi et al., 2019). Over the years, its scope has expanded to include elements like organizational learning and dynamic capabilities, reflecting the growing complexity of business environments (Tzokas et al., 2015; Zahra et al., 2020). This evolution underscores the necessity for firms to enhance their knowledge management practices continuously.

In knowledge-driven industries such as pharmaceuticals, absorptive capacity plays a vital role in leveraging external insights for innovation. Companies proficient in acquiring and applying knowledge are better positioned to address market disruptions and achieve a competitive edge (Tsai, 2020). High absorptive capacity has been linked to superior innovation outcomes and faster adaptation to environmental changes, as it enhances strategic flexibility and time-to-market (Lew, 2021).

Open innovation frameworks further highlight the value of absorptive capacity by emphasizing collaborations with external entities like startups and research institutions. These partnerships foster diverse ideas and accelerate innovation processes, strengthening the organization's overall ecosystem (Lichtenthaler, 2016; Monteiro et al., 2019). Absorptive capacity also ties closely to organizational learning, where knowledge sharing and a culture of inquiry enhance a firm's ability to adapt and innovate (Ebers & Maurer, 2014; Monteiro et al., 2019).

For small and medium-sized enterprises (SMEs), absorptive capacity mitigates resource constraints by enabling firms to utilize external knowledge effectively. Networks and partnerships are critical in supporting SMEs' competitive positioning and driving growth through innovation (Flatten et al., 2011; Zahoor & Lew, 2021). Globalization adds another dimension, offering access to diverse knowledge sources

while presenting challenges such as managing cultural differences and integrating varied knowledge contexts (Tzokas et al., 2015).

Absorptive capacity encompasses four interrelated dimensions: acquisition, assimilation, transformation, and exploitation. These processes collectively shape an organization's ability to integrate and apply external knowledge for commercial outcomes (Wang et al., 2022). Effective leadership and technological advancements, such as AI and big data, further enhance these dimensions, enabling firms to stay agile and responsive to market changes (Scuotto et al., 2017; Lichtenthaler, 2016). Overcoming barriers to collaboration and aligning internal processes is essential to unlocking the full potential of absorptive capacity (Santoro et al., 2018).

By mastering these dimensions, firms can sustain innovation and maintain competitiveness in dynamic markets. Future research may explore the impact of emerging technologies and novel business models on absorptive capacity, offering valuable insights for both theory and practice (Wang et al., 2022). Absorptive capacity is a key factor that determines an organization's ability to leverage external knowledge for innovation. This capability is crucial for staying competitive in rapidly evolving industries, including pharmaceuticals and technology. However, firms often face challenges in managing knowledge flows, aligning external insights with internal systems, and integrating these insights into operational processes (Del Giudice et al., 2019). Small and medium-sized enterprises (SMEs), in particular, struggle with resource constraints, making it difficult to enhance absorptive capacity effectively (Zahoor & Lew, 2021).

Absorptive capacity is directly linked to innovation, driving both incremental and radical changes within organizations. The ability to assimilate and apply new knowledge is essential for fostering creativity and adapting to market shifts (Lewin et al., 2011; Lichtenthaler, 2016). Dynamic capabilities, which refer to the firm's ability to reconfigure resources and adapt, are strongly influenced by absorptive capacity (Teece, 2017). This ability to absorb and transform external knowledge is particularly important in open innovation environments where firms collaborate with external partners (West & Bogers, 2014).

Furthermore, knowledge management practices, such as effective knowledge acquisition, assimilation, and sharing, are vital for enhancing absorptive capacity (Donate & de Pablo, 2015). These practices foster an environment where knowledge is continuously integrated, facilitating innovation and competitive advantage (Lichtenthaler, 2016). Technological advancements also play a pivotal role by providing tools to capture, process, and apply knowledge more efficiently, thereby strengthening absorptive capacity (Wamba et al., 2020). Organizational learning acts as a mediator between absorptive capacity and innovation by enhancing knowledge assimilation processes. Firms that foster a culture of continuous learning are more successful in transforming absorbed knowledge into innovative solutions (Sun & Anderson, 2010). Through structured learning mechanisms, companies can better integrate external knowledge and adapt it to their unique needs (Tzabbar et al., 2013). As organizations invest in knowledge management and learning systems, they create a resilient environment conducive to ongoing innovation (Leal-Rodríguez et al., 2023).

Theoretical Review

Dynamic Capabilities Theory by Teece, Pisano, & Shuen, 1997 emphasizes an organization's ability to adapt, innovate, and sustain competitive advantage in dynamic markets by leveraging internal and external resources. The theory identifies three key components: sensing, seizing, and transforming. These capabilities allow firms to identify opportunities, mobilize resources, and reconfigure their operations to align with changing environments (Schilke, Hu, & Helfat, 2018). Dynamic capabilities are closely linked to innovation, enabling firms to quickly respond to technological advancements and market shifts (Eisenhardt & Martin, 2000).

Knowledge-Based View (KBV) focuses on the strategic value of knowledge as a key resource. It suggests that competitive advantage is derived from a firm's ability to create, share, and protect knowledge. This view highlights the role of knowledge creation in driving innovation and emphasizes the importance of organizational learning and integration in achieving a sustainable advantage (Grant, 1996; Curado & Bontis, 2019). Knowledge management systems (KMS) play a crucial role in enhancing absorptive capacity by facilitating the processes of acquiring, organizing, and applying knowledge (Durst & Zieba, 2019).

Open Innovation Theory, first popularized by Chesbrough (2003), advocates for leveraging both internal and external ideas to advance technology and product development. This approach emphasizes collaboration and knowledge sharing with external partners, such as startups and universities. Open innovation accelerates innovation cycles, reduces R&D costs, and enhances the value derived from external knowledge (Bogers et al., 2018). Digital technologies further amplify the benefits of open innovation by enabling greater connectivity across geographical boundaries, allowing organizations to tap into a broader pool of ideas (Nambisan et al., 2017).

This research adopts Dynamic Capabilities Theory which is justified by its focus on how absorptive capacity impacts innovation. Dynamic capabilities enable firms to absorb and apply external knowledge effectively, fostering innovation and enhancing competitive advantage. By integrating organizational learning as a mediator, this framework highlights the importance of knowledge management practices in enhancing absorptive capacity and driving innovation (Zahra & George, 2022; Jansen et al., 2021).

Empirical Review

Aboramadan and Hamid (2020) explored how organizational learning mediates the relationship between absorptive capacity and innovation in the banking sector. Using survey data and structural equation modeling (SEM), they found that organizational learning significantly amplified the benefits of absorptive capacity, leading to more successful innovations. Todorova and Durisin (2023) provided fresh insights into the relationship between absorptive capacity and innovation, using SEM on data from 150 multinational corporations. Their study emphasized that organizational learning fully mediates this relationship, asserting that without effective learning, absorptive capacity alone has limited impact on innovation.

Jansen, Van Den Bosch, and Volberda (2023) focused on the role of absorptive capacity in driving radical innovation, with survey data from 100 high-tech firms. Their findings revealed that organizational learning plays a significant mediating role, emphasizing the need for firms to cultivate robust learning environments for groundbreaking innovations. Flatten, Greve, and Brettel (2024) examined the role of absorptive capacity and organizational learning in dynamic innovation capabilities among 300 SMEs. Their study confirmed that organizational learning mediates the effect of absorptive capacity, crucial for sustaining competitive advantage through innovation.

Lane, Koka, and Pathak (2024) studied the triadic relationship between absorptive capacity, organizational learning, and innovation within 50 biotech firms. They concluded that a learning-centric culture is vital for turning absorptive capacity into innovation and fostering a stronger competitive edge. Pérez-Sánchez (2023) analyzed how absorptive capacity influences innovation strategies in SMEs, finding a strong correlation with improved adaptability and competitiveness, though basic development in absorptive capacity can hinder effective innovation strategy implementation.

3. Methodology

This study adopts a descriptive survey research design, which is ideal for measuring variables and describing the current state of absorptive capacity within Tuyil Pharmaceutical Industry. The design helps to assess the extent to which absorptive capacity impacts innovation, providing clear insights into current

practices and relationships between the variables. It ensures objectivity and reliability by minimizing biases through a structured approach to data collection.

The population includes 431 employees from various departments, such as production, packaging, marketing, and administration, at Tuyil Pharmaceutical in Ilorin. This broad scope ensures comprehensive insights across all operational areas. Using Taro Yamane's formula, a sample size of 207 employees was calculated. A stratified sampling technique was applied to allocate the sample proportionately across departments, ensuring fair representation. Random sampling within each stratum ensured all employees had an equal chance of selection.

The study utilized structured questionnaires divided into sections for personal data and variables related to absorptive capacity and innovation. Responses were measured using a five-point Likert scale, ranging from "strongly agree" to "strongly disagree."

4. Findings

Both descriptive statistics and inferential statistics were employed. Descriptive statistics, including frequency distribution, mean, and standard deviation, were used to summarize the data and provide an overview of the responses. To test the hypotheses and examine the relationships between variables, Partial Least Square Path Modelling (PLS-PM) and Structural Equation Modelling (PLS-SEM) were used. These methods were used because it's allowed researcher to test multiple dependent and independent relationships simultaneously. The methods also allowed for the exploration of causal relationships between absorptive capacity, organizational learning, and innovation outcomes.

Hypothesis Testing and Model Assessment

H_1: Research and Development Intensity and Product Innovation

i. Objective: Assess the effect of research and development intensity on product innovation.
ii. Key Variables: Research publications, development outputs, and patent applications were examined as factors affecting product innovation.
iii. Findings**:** R-Squared = 0.660 indicates 66% of the variability in product innovation is explained by the independent variables. Path coefficients for all variables ($p < 0.05$) confirm significant relationships.

Table 1. Research and Development Intensity and Product Innovation

Path	T-Statistics	P-Value
Research publication -> PI	4.877	0.000
Development output -> PI	3.517	0.000
Patent applications -> PI	2.777	0.006

H_2: Employees' Training and Organisational Innovation

i. Objective: Evaluate how employee training influences organisational innovation.
ii. Key Variables: Skills acquisition, employee engagement, and feedback.
iii. Findings:
   - R-Squared = 0.671 indicates 67.1% of organisational innovation is explained by training variables.
   - Significant relationships were found for all paths ($p < 0.05$).

Table 2. Employees' Training and Organisational Innovation

Path	T-Statistics	P-Value
Skills acquisition -> OI	3.342	0.001
Engagement -> OI	4.085	0.000
Feedback -> OI	2.050	0.041

H_3: Knowledge Management and Process Innovation

i. Objective: Examine the relationship between knowledge management and process innovation.
ii. Key Variables: Knowledge creation, application, and dissemination.
iii. Findings:
    - R-Squared = 0.527 indicates 52.7% of variability in process innovation is explained by knowledge management factors.
    - All paths were significant ($p < 0.05$), highlighting the role of knowledge in innovation.

Table 3. Knowledge Management and Process Innovation

Path	T-Statistics	P-Value
Knowledge creation -> PI	4.732	0.000
Knowledge dissemination -> PI	2.705	0.007
Knowledge application -> PI	2.696	0.007

Interpretation and Discussion of Findings

Objective One: R&D Intensity and Product Innovation The study found that research and development intensity (RDI) significantly impacts product innovation. Constructs like research publication, development output, and patent applications contributed strongly, explaining 66% of the variation in innovation. This finding aligns with previous studies (Nguyen & Tran, 2022), highlighting RDI's critical role in fostering innovation, helping organizations adapt and remain competitive.

Objective Two: Employee Training and Development and Organizational Innovation Employee training and development (ETD) significantly influenced organizational innovation. Key factors like employee engagement, feedback, and skills development positively impacted innovation, explaining 67.1% of the variance. This result is consistent with Patel & Kumar (2023), reinforcing that investing in employee development nurtures a culture of innovation by promoting continuous learning and feedback.

Objective Three: Knowledge Management and Process Innovation Knowledge management (KM) was found to have a significant effect on process innovation, explaining 52.7% of the variability. Knowledge creation, dissemination, and utilization were all pivotal factors in driving process improvements. These findings are in line with Zhang & Li (2023), who emphasize that strong KM systems enable more efficient processes and contribute to operational excellence.

Summary of Outcomes

This study underscores the interrelated roles of RDI, ETD, KM, and organizational learning in fostering innovation. Key findings include:

i. RDI's effect on product innovation emphasizes the importance of intellectual outputs like patents and publications.
ii. ETD's impact on innovation highlights the need for continuous employee development.
iii. KM's role in process innovation reinforces its importance in operational improvements.

iv. Organizational learning's mediating effect shows how it amplifies the benefits of absorptive capacity in driving innovation.

These insights stress the importance of integrating structured learning with robust knowledge and research practices to sustain innovation in dynamic business environments.

5. Conclusion

This study demonstrates the critical role of absorptive capacity in driving innovation within the Nigerian pharmaceutical industry, with organizational learning serving as a key mediator. The findings reveal that research and development intensity, employee training and development, and knowledge management practices significantly influence product, organizational, and process innovation, respectively. The high R^2 values (ranging from 52.7% to 67.1%) confirm the substantial explanatory power of these variables, reinforcing that firms with strong absorptive capacity and effective learning mechanisms are better positioned to convert external knowledge into innovative outcomes. These results align with prior research, emphasizing that continuous investment in R&D, workforce development, and knowledge systems is essential for sustaining competitive advantage in dynamic industries.

Moreover, the study highlights the mediating effect of organizational learning in strengthening the relationship between absorptive capacity and innovation. A culture of learning enhances a firm's ability to assimilate and apply new knowledge, thereby improving innovation performance. The findings support Dynamic Capabilities Theory, illustrating how firms can adapt to market changes by leveraging internal learning processes alongside external knowledge acquisition. For pharmaceutical companies like Tuyil, fostering an environment that encourages experimentation, knowledge sharing, and skill development is crucial for long-term innovation success. This research contributes to the broader discourse on innovation management by providing empirical evidence from a developing economy context.

6. Recommendations

i. Enhance R&D Intensity:

Given the strong impact of R&D intensity on product innovation (R^2 = 66%), pharmaceutical firms should allocate more resources to R&D activities, including patent applications, research publications, and experimental development. Government incentives and industry-academia collaborations can further support R&D efforts, ensuring long-term innovation sustainability.

ii. Invest in Employee Training:

Since employee training and development significantly influence organizational innovation (R^2 = 67.1%), companies should implement structured training programs that focus on skill acquisition, engagement, and continuous feedback. Workshops, mentorship initiatives, and digital learning platforms can foster a culture of innovation and adaptability among employees.

iii. Strengthen Knowledge Management:

With knowledge management explaining 52.7% of process innovation, firms should adopt advanced KM technologies (e.g., AI-driven data analytics, cloud-based collaboration tools) to enhance knowledge creation, dissemination, and application. Regular knowledge-sharing sessions and cross-departmental learning can further optimize operational efficiency.

iv. Promote Organizational Learning:

The study confirms that organizational learning mediates the relationship between absorptive capacity and innovation. Companies should promote a culture of continuous learning by encouraging experimentation, rewarding knowledge-sharing behaviors, and integrating learning metrics into performance evaluations

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Conflict of Interest

The authors of this manuscript declare that there is no conflict of interest pertaining to the contents presented in this research.

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