

**When complementarity rhymes with urgency :
Strategic insights from the accelerated development
of the Pfizer–BioNTech COVID-19 vaccine**

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ABSTRACT

Amid unprecedented turbulence and pressing health challenges, firms are pushed to innovate faster and smarter, often through strategic alliances. This article explores how resource complementarity and strategic vision alignment can turn collaborative innovation into a powerful lever for breakthrough performance. Drawing on an in-depth qualitative case study of the Pfizer–BioNTech partnership for COVID-19 vaccine development, the study highlights how a biotech’s cutting-edge mRNA expertise and a pharmaceutical giant’s global regulatory and manufacturing capabilities were orchestrated to deliver an effective vaccine in record time. The analysis uncovers four decisive success factors in such high-stakes alliances : strong technological complementarity,

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robust and shared governance, committed top management, and agile operational choices under extreme time pressure. By combining the Resource-Based View with the open innovation lens, the article shows how partners can co-create value well beyond their individual capacities. The study concludes with concrete recommendations for managers and policymakers aiming to leverage these lessons within emerging innovation ecosystems

KEYWORDS : strategic alliances, open innovation, resource complementarity, vision alignments, Pfizer, BioNTech

JEL CLASSIFICATION CODES : L24, O31, O32, D23

I. INTRODUCTION

The COVID-19 pandemic revealed the essential importance of collaborations, particularly in terms of effective innovations between organizations, notably in the healthcare sector, which requires rapid responses, testing organizations' ability to innovate and collaborate effectively to optimize time and dominate the market (Pfizer, s. d.; Pfizer and BioNTech to Co-Develop Potential COVID-19 Vaccine, s. d.) The synergy of resources and skills between partners, as well as strategic alignment, are frequently mentioned in the literature as essential levers for overcoming the challenges associated with complexity, uncertainty, and urgency during times of crisis (Acebo et al., 2021; De Groote et al., 2023)

In 2020, the partnership between Pfizer and BioNTech for the creation of the COVID-19 vaccine illustrates how innovative collaborations can quickly respond to global challenges. This partnership allowed for the design, development, testing, and distribution of a vaccine in record time thanks to the synergy of each entity's strengths (Amy & Lisa, 2020)

This study aims to analyze, based on literature data, how the complementarity between partners and the alignment of visions promote the success of innovation projects, drawing on the case of "Pfizer & BioNTech" to address our problem and the following research questions :

How does the synergy of resources and skills with a vision alignment between partners promote the success of innovation projects?

- 1. What is the impact of aligning strategic perspectives on the performance of innovative alliances ?***
- 2. What lessons can we learn from the Pfizer-BioNTech case to understand the success factors of partnerships ?***

Our research has a dual objective : on the one hand, to analyze to what extent the complementarity of resources and strategic alignment between partners contribute to the performance of innovation projects; on the other hand, to formulate recommendations based on the lessons learned, which could inform decision-making in the selection and management of innovative alliances for companies wishing to establish strategic innovation alliances, particularly in the Algerian context

II. LITERATURE REVIEW

This review explores how the complementarity of resources and skills, as well as an alignment of strategic visions among partners, influences the success of innovation projects.

1. THE SYNERGY OF RESOURCES AND COMPETENCIES

The principle of resource complementarity asserts that the aggregate value of diverse resources possessed by collaborating entities surpasses the total of their individual contributions, thereby generating synergistic benefits (Khraishi et al., 2020)

This is particularly evident in innovation projects where partners contribute specialized knowledge, technologies, or access to markets and networks. The integration of these resources facilitates the creation of unique solutions unattainable by a single

entity, which is vital for SMEs that frequently depend on external alliances and partnerships to mitigate resource constraints and enhance their innovation capabilities (Franco & Haase, 2020; Vătămănescu et al., 2020)

Open innovation methods for small and medium-sized organizations (SMEs) necessitate the amalgamation of specialized external resources and tacit knowledge with internal assets to create enhanced value and promote collaborative innovation (De Groote et al., 2023; Khraishi et al., 2020) The notion of open innovation, articulated by Chesbrough (2003) (Bogers et al., 2019; Ettabaa et al., 2019) asserts that organizations ought to use external ideas alongside internal ones, utilizing both internal and external routes to market access. This concept highlights that intriguing ideas may arise and be monetized both within and externally to the firm

Three forms of open innovation are delineated in the literature: (Aouinaït et al., 2025)

- **Outbound innovation** : dissemination of untapped internal inventions outside
- **Inbound innovation** : procurement of external concepts and solutions to enhance the internal innovation process
- **Coupled innovation** : integration of the aforementioned processes through co-creation with synergistic partners

Complementary resources enable firms to enhance their knowledge base, leading to improved innovation performance through the creation of new goods and services, which results in superior market alignment and decreased development time and costs (Engelsberger et al., 2023) Consequently, the attainment of shared innovation objectives and enhanced performance within collaborative networks

is facilitated by studies indicating that the primary impetus for collaborative innovation stems from limited and inadequate resources, necessitating complementary partnerships in skills and resources (Arsanti et al., 2022)

(Das & Teng, 2000) identify four categories of resource alignment in alliances

- **Supplementary alignment:** both partners provide comparable and high-performing resources.
- **Excessive alignment:** underutilization of comparable resources
- **Complementary alignment:** use of different yet compatible resources
- **Wasteful alignment:** utilization of dissimilar and incompatible resources

Research indicates that supplemental and complementary alignments enhance alliance success, since partners provide distinct and non-redundant resources.

The complementarity of talents and technical compatibility are essential success criteria, with partnerships thriving when partners provide really complementary assets instead of duplicating capabilities (Acebo et al., 2021; Das & Teng, 2000; De Groote et al., 2023)

2. THE ALIGNMENT OF STRATEGIC VISION

A collective strategic vision offers a cohesive framework for partners to align individual contributions with shared innovation objectives (Chierici et al., 2021) We alleviate possible conflicts

arising from differing interests among partners, promoting a unified setting and atmosphere favorable to collaborative problem-solving and value co-creation (Malik et al., 2024) It also fortifies trust and commitment among partners, which are crucial for managing uncertainties and adjusting to environmental and market conditions.

A precise description of shared objectives enhances resource allocation and coordinated decision-making, guaranteeing optimal utilization of the partners' collective efforts for innovation (Schiefer et al., 2024) The collective comprehension of strategic objectives greatly affects the recognition of possibilities and the assimilation of information from many partners, therefore influencing innovation performance. A deficiency in strategy coherence may result in project failure (Xie et al., 2022; X. Zhang et al., 2025; Y. Zhang et al., 2013)

The successful amalgamation of complementary resources and abilities is greatly improved by robust strategic alignment, since this guarantees that varied contributions are directed towards shared innovation objectives. This synergy enables the best utilization of divers assets and abilities, converting individual strengths into a unified and formidable force for innovation. This integration enables organizations to utilize shared technological resources and expertise, thereby enhancing their research and development and innovation capabilities , while also reducing redundancy and optimizing resource allocation within the collaboration (Rajan et al., 2021; Wei et al., 2025)

In conclusion, it also promotes the utilization of inter-organizational learning, enabling partners to efficiently assimilate and implement new knowledge from collaborative endeavors,

thereby facilitating a more effective transfer of knowledge that integrates diverse perspectives and specialized expertise to improve problem-solving and innovation capabilities (Rezaei, 2024; Zahoor & Al-Tabbaa, 2020)

III. METHODOLOGY

1. Methodological framework

This study employs an exploratory qualitative methodology centered on a singular case study, using Yin 2009 (Aberdeen, 2013) for a comprehensive examination of modern phenomena within their real-world context. The case study is validated by its capacity to thoroughly analyze a "case" within its "real-life" setting.

This approach is especially suitable for examining the collaborative dynamics between Pfizer and BioNTech within the context of the pandemic.

2. Data acquisition

The data was obtained from documentary sources :

Primary official sources:

- Press releases sent by Pfizer and BioNTech (2020-2022)
- Annual reports from both firms
- Regulatory documentation (FDA, EMA)
- Publicly publicized partnership contracts

Scholarly references:

- Articles disseminated in peer-reviewed journals
- Scientific papers examining the Pfizer-BioNTech case

Institutional sources:

- Reports from the World Health Organization and health authorities
- Documents from the European Commission

Source : (Amy & Lisa, 2020; Andy Widger, 2020; Full article: Public health impact of the Pfizer-BioNTech COVID-19 vaccine (BNT162b2) in the first year of rollout in the United States, s. d.; Pfizer and BioNTech Dose First Participants in the U.S. as Part of Global COVID-19 mRNA Vaccine Development Program | Pfizer, s. d.; Pfizer and BioNTech Initiate Study to Evaluate Omicron-Based COVID-19 Vaccine in Adults 18 to 55 Years of Age | Pfizer, s. d.; Marie Joëlle Jabagil et al., 2021; Pfizer, 2020) (Oliver et al., 2021; Pfizer and BioNTech to Co-Develop Potential COVID-19 Vaccine, s. d.; Pfizer, 2020) (Aouinaït et al., 2025; Lewis et al., 2023; Oliver et al., 2021; Piroozi et al., 2025)

3. Data analysis

The investigation employed a thematic content analysis technique, facilitating the discovery of factors related to resource complementarity and strategy alignment. The predetermined topics from the literature review (resource complementarity, strategy alignment, success determinants) were juxtaposed with the actual data derived from the case study (Al Jabri & Lahrech, 2025; AL MOUHANI Zouhair et al., 2021; *Critical Success Factors in Managing Strategic Alliances and Knowledge for Organizational Innovations: Insights With M-TISM and MICMAC* | *IEEE Journals & Magazine* | *IEEE Xplore*, s. d.; Qiu et al., 2024)

4. Criteria for Validity

Internal validity was secured by the integration of sources and the alignment of interpretations with established literature. External validity, while constrained by the case's distinctive characteristics, is enhanced by its theoretical foundation in recognized frameworks such as the Resource-Based View (RBV) and open innovation (Chesbrough, 2003; Das & Teng, 2000)

➤ CASE STUDY : THE PFIZER–BIONTECH COLLABORATION FOR COVID-19 VACCINATION

1. Framework and organization of the collaboration

In March 2020, Pfizer and BioNTech formed a strategic alliance to expedite the development of a COVID-19 vaccine, integrating BioNTech's proficiency in messenger RNA (mRNA) technology with Pfizer's extensive global clinical, regulatory, and logistical development framework. This agreement is a continuation of prior collaboration, since the two businesses previously collaborated in 2018 on the development of an mRNA-based influenza vaccine

(Andy Widger, 2020; Lewis et al., 2023; Marie Joëlle Jabagi et al., 2021; Pfizer, 2020)

2. Resource Complementarity and Strategic Alignment

The examination of the collaboration indicates a complementary resource alignment framework (Das & Teng, 2000). BioNTech contributed its specialist knowledge in nucleoside-modified mRNA

platforms, whereas Pfizer used its regulatory, manufacturing, and worldwide distribution proficiencies. Mikael Dolsten, Pfizer's Chief Scientific Officer, remarked: *"This productive partnership equips our companies with the requisite strength to swiftly mobilize our collective resources in response to this global challenge"* (Di Fusco et al., 2022; Pfizer, s. d., 2020; *Pfizer and BioNTech Dose First Participants in the U.S. as Part of Global COVID-19 mRNA Vaccine Development Program* | Pfizer, s. d.)

The strategic alignment was demonstrated by a collective vision of health emergencies. Ugur Şahin, co-founder and CEO of BioNTech, stated: **"By collaborating with Pfizer, we believe we can expedite our endeavors to deliver a COVID-19 vaccine to all who require it"** (Pfizer, 2020) This alignment enabled collaborative decision-making and the equal distribution of risks and resources, based on a 50/50 paradigm.

3. Essential Determinants of Success

The comparative examination of the case with the literature reveals seven critical performance factors:

Factor	Manifestation in the case	Theoretical grounding
Technological complementarity	mRNA technology + large-scale manufacturing capabilities	Resource-Based View (RBV)
Goal alignment	Shared vision of responding to the pandemic emergency	Strategic alignment
Prior experience	Pre-existing collaboration on an mRNA-based influenza vaccine (2018)	Absorptive capacity

Managerial support	Visible commitment of CEOs and senior scientific leadership	Strategic leadership
Clear governance	50/50 cost sharing, joint steering committees	Governance structure
Operational flexibility	Parallel rather than sequential development	Collaborative innovation
Intellectual property management	Predefined and transparent contractual framework	Coordination mechanisms

Source : Developed by the authors, based on referenced methodologies.

4. Outcomes and efficacy

The partnership's performance metrics demonstrate its exceptional success: The partnership's performance indicators demonstrate its exceptional success:

- ✓ **Expedited timeline:** 9 months from the initiation of clinical trials to emergency authorization (compared to the typical 10-15 years)
- ✓ **Clinical effectiveness:** 95% efficacy (confidence interval 90%-97%, $p < 0.0001$)
- ✓ **Production capacity:** Exceeding 3 billion doses manufactured in 2021
- ✓ **Geographic scope:** Presence in 186 international markets
- ✓ **Health impact:** An estimated 9 million symptomatic cases averted, 700,000 hospitalizations stopped, and 110,000 fatalities saved in the initial year.

This outstanding accomplishment demonstrates how the synergy of resources, strategic alignment, and efficient governance may

generate synergistic value in collaborative innovation initiatives within emergency situations.

Source : (Amy & Lisa, 2020; Andy Widger, 2020; Di Fusco et al., 2022, 2022; Pfizer and BioNTech Choose Lead mRNA Vaccine Candidate Against COVID-19 and Commence Pivotal Phase 2/3 Global Study | Pfizer, s. d.; Pfizer and BioNTech Initiate Study to Evaluate Omicron-Based COVID-19 Vaccine in Adults 18 to 55 Years of Age | Pfizer, s. d.; Pfizer and BioNTech Receive Authorization in the European Union for COVID-19 Vaccine | Pfizer, s. d.; Pfizer and BioNTech to Co-Develop Potential COVID-19 Vaccine, s. d.; Pfizer expands manufacturing efforts to increase COVID-19 vaccine supply globally | Pfizer 2021 Annual Report, s. d.; Pfizer, 2020, 2020)

IV. DISCUSSION

The literature and the Pfizer & BioNTech instance demonstrate that the success of innovation initiatives depends on the integration of several complimentary variables. A multitude of pragmatic suggestions arises for managers: (AL MOUHANI Zouhair et al., 2021; Critical Success Factors in Managing Strategic Alliances and Knowledge for Organizational Innovations: Insights With M-TISM and MICMAC | IEEE Journals & Magazine | IEEE Xplore, s. d.; Innovation Partnerships: 7 Success Factors for 2025, s. d.; Cummings & Holmberg, 2012; Kale & Singh, 2007)

- ✓ **Assess the genuine complementarity :** Before building an alliance, precisely map each partner's resources and talents to guarantee actual complementarity rather than redundancy.
- ✓ **Establish an early strategic alignment:** Explicitly delineate shared objectives and governance structures during the negotiating phase.

- ✓ **Establish a definitive intellectual property framework:** Organizations who perform prior art research and implement definitive IP ownership frameworks have 67% enhanced innovation capacity.
- ✓ **Mobilize managerial support:** The active endorsement of leaders is a fundamental element that directly impacts innovation success.
- ✓ **Embrace agile methodologies:** Parallel development, despite its cost risks, can considerably accelerate timeframes in emergency situations.

1. APPLICABILITY TO THE ALGERIAN CONTEXT :

Present condition of the Algerian innovation ecosystem :The Algerian innovation ecosystem has several structural deficiencies as highlighted by foreign analyses by (Green and Digital Economic Development in Algeria | GIZ, 2022)

- ✓ Inadequate collaboration among stakeholders
- ✓ Disintegration of support frameworks
- ✓ Challenges in securing funding for innovative SMEs/SMIs
- ✓ Restricted connections between universities, enterprises, and society

Nonetheless, recent attempts exhibit a favorable trend in October 2025, Algérie Télécom Annaba executed eight strategic cooperation agreements with academic institutions and incubators to foster innovation and entrepreneurship. The World Intellectual Property Organization reaffirmed its dedication to assisting Algeria's national development objectives and enhancing the intellectual

property framework (Saada, 2025; WIPO Director General Pledges Support to Strengthening Algeria's Innovation Ecosystem, s. d.)

2. TRANSFERABILITY CONDITIONS

The success elements recognized in the Pfizer-BioNTech instance are partially applicable to the Algerian environment, contingent upon specific variables.

Beneficial elements:

- The EU-Algeria scientific and technology agreement, inked in 2012, establishes a framework for research partnerships.
- The Horizon Europe initiative permits Algerian involvement in international research consortia.
- Recent UNIDO agreements focus on technology transfer and capacity enhancement in green technology and the pharmaceutical sector.

Challenges to address:

- Enhance collaboration within the innovation ecosystem
- Augment the capabilities of support structures (financial resources, educational institutions)
- Elevate the status of SMEs to optimize their utilization of digital technologies
- Enhance stakeholders' understanding of innovative methodologies.

(Arribi & Boutarfa, 2024; Bahloul, 2025; *Green and Digital Economic Development in Algeria* | GIZ, 2022; WIPO Director General Pledges Support to Strengthening Algeria's Innovation Ecosystem, s. d.; Saada, 2025; Vasiliev & Zherlitsina, 2018)

3. TARGETED PROPOSALS FOR ALGERIA

- Algerian enterprises should pursue collaborations with multinationals that provide complementary resources such as technology, market access, and regulatory experience.
- Incubators such as Hedje Startup Incubator in Annaba can significantly facilitate the connection of complementary partners.
- Leverage international initiatives : Engage actively in collaborative Algeria-Italy research and innovation project calls.
- Elucidate the regulations governing intellectual property in public-private partnerships and international cooperation.

(AL MOUHANI Zouhair et al., 2021; Aouragh & Bouteldja, 2024; Kale & Singh, 2007; Saada, 2025)

4. CONSTRAINTS OF THE RESEARCH

This study has some problems that require acknowledgment:

- The singular case study, while abundant in insights, constrains the applicability of the findings to other sectors or geographical situations
- The Pfizer-BioNTech instance exemplifies an extraordinary achievement, perhaps leading to a survival bias in the determination of success variables.

- The study is solely based on documentation evidence, without direct insights from the participating participants

5. RESEARCH PERSPECTIVES

This study has several research opportunities :

- **Comparative analyses** : Examine more innovative partnerships within the pharmaceutical industry to discern prevalent trends or different configurations of success.
- **Longitudinal research**: Examine the progression of innovative collaborations over an extended period to comprehend the mechanisms of sustaining or terminating alliances.
- **Empirical investigations in Algeria** : Execute qualitative and quantitative research on inter-organizational collaboration practices within the Algerian setting

V. CONCLUSION

The triumph of the Pfizer–BioNTech partnership exemplifies the efficacy of complementarity and strategic alignment in innovation. The combination of these two pillars, bolstered by nimble governance, prior experience, and trust, facilitated the conversion of resources into concrete outcomes.

In response to the study question : The complementarities among partners and the explicit alignment of vision are critical factors for the success of innovation initiatives during crises. They expedite implementation and enhance market effect, while also aiding regulatory clearances and optimizing financial performance, as seen by the Pfizer & BioNTech instance.

This study examined the determinants of success in collaborative innovation projects by employing the theoretical framework of the Resource-Based View and the open innovation paradigm. The examination of the Pfizer-BioNTech instance indicates that resource complementarity and strategy alignment are essential factors influencing inventive success in asymmetric collaborations.

This research presents three primary contributions. Initially, it experimentally validates the significance of the resource alignment typology (Das & Teng, 2000) in elucidating the performance of innovation partnerships. Furthermore, it demonstrates how open innovation may be efficiently harnessed in emergency situations necessitating a swift acceleration of development processes. Thirdly, it provides a transferable analytical framework, with requisite modifications, for emergent situations such as Algeria

The findings underscore the necessity for organizations to have a strategic capability to recognize and engage complementary partners at the management level. This capability entails a thorough evaluation of the resources and competencies of prospective partners, as well as the creation of governance structures that facilitate the alignment of objectives and the coordination of activities.

This study indicates that Algerian public decision-makers should enhance the innovation ecosystem through policies that foster inter-organizational cooperation, the establishment of intermediary organizations, and integration into international research networks. Establishing strategic collaborations with foreign entities, with the enhancement of domestic capabilities, is a viable avenue for expediting innovation within the Algerian setting

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