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The Influence of Internal Factors and Customer Relations on the Success of Big Data and AI Projects with Moderating Government Regulations at PT. Dua Empat Tujuh

Bagus Rully Muttaqien and Slamet Ahmadi
Postgraduate Masters in Management, Universitas IPWI Jakarta
email: bagusrullymuttaqien@gmail.com

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Abstract

This study aims to evaluate the effectiveness of government regulations in supporting product innovation strategies, human resource management, and data protection in the context of digital transformation based on artificial intelligence (AI) and big data technology. This study was conducted using a literature study approach, referring to various academic sources including strategic management textbooks, innovation, marketing, and the latest journal articles that discuss the relationship between government policies and organizational performance. The results of the study indicate that government regulations can provide constructive direction and limitations on the application of technology, but also have the potential to hinder organizational agility if not balanced with adaptive strategies. In this context, the company's ability to manage human resources, build ethical customer relationships, and encourage innovation that complies with regulations is the key to success. This study emphasizes the importance of integration between regulatory compliance and strategic flexibility in developing sustainable and competitive business models in the digital era.

1. Introduction

The rapid advancement of information and communication technology has ushered the world into the era of digitalization, marked by the Fourth Industrial Revolution and a shift toward a data-driven economy. Big Data and Artificial Intelligence (AI) have become the two core elements of this transformation, acting as catalysts for innovation, efficiency, and competitive advantage across sectors (Brynjolfsson & McAfee, 2014). Big Data refers to data characterized by high volume, variety, and velocity (3Vs), requiring new approaches to processing and analysis. Meanwhile, AI enables intelligent data processing, pattern recognition, and algorithm-based solutions (Davenport & Harris, 2017).

In the global business landscape, Big Data and AI are driving digital transformation by helping firms better understand consumer behavior, predict market trends, and make data-driven decisions. AI enhances this process through predictive analytics, process automation, and customer experience optimization. According to Gartner (2024), 75% of global companies have integrated AI into their digital transformation strategies, creating opportunities to be more responsive, adaptive, and personalized in meeting customer needs.

The benefits of Big Data and AI extend beyond internal data processing and significantly impact relationships with customers, technology partners, and stakeholders. These technologies allow companies to build predictive models, optimize operations, and reduce costs (McKinsey, 2020). AI technologies such as machine learning and deep learning generate automated recommendations, enhance efficiency, and foster market-relevant innovation.

However, successful implementation of Big Data and AI relies not only on the technology itself but also on a strong strategic ecosystem. This includes four key factors: strategic collaboration with technology partners, product research, human resource capabilities, and customer relationship management. Strategic collaboration ensures access to technical expertise and innovation (Dyer & Singh, 1998), while product research—especially open-

source—drives value-added and market-relevant solutions (Nonaka & Takeuchi, 1995). Human capital capability ensures project execution, and customer relationship management sustains projects through high satisfaction (Reichheld, 1996). Many organizations struggle to build effective partnerships, particularly in ensuring infrastructure readiness and technical support (Deloitte, 2021).

Government regulation also plays a vital role. In Indonesia, policies such as the Domestic Component Level (TKDN) and the Personal Data Protection Law (PDP Law No. 27/2022) shape technological development and implementation (Ministry of Industry, 2011). TKDN promotes the use of local components without compromising global competitiveness, while PDP Law ensures secure and transparent customer data management. Thus, government regulation acts as a moderating variable that can either enhance or limit the impact of strategic factors on project success. Regulations related to data privacy, cybersecurity, and system interoperability can directly affect how Big Data projects are implemented in industries and public sectors (Kominfo, 2023).

The World Economic Forum (2023) reports that one of the main challenges to Big Data and AI success is the lack of skilled workers. 56% of Asia-Pacific companies, including those in Indonesia, struggle to recruit competent AI talent. Human resource competency thus emerges as a critical success factor. Furthermore, Big Data and AI solutions require ongoing research to stay market-relevant. A Harvard Business Review (2023) study revealed that 80% of AI projects fail due to poor user need understanding and weak product research validation.

Globally, investment in these technologies continues to rise. Gartner estimates global data center spending will grow by 24.1% to $293.09 billion in 2024, driven by increasing AI infrastructure demands (Investopedia, 2024). The global data center industry is projected to grow from $416 billion in 2023 to $624 billion by 2029 (Financial Times, 2024).

PT Dua Empat Tujuh (SOLUSI247) is an Indonesian technology firm operating since 2000, specializing in Big Data and AI solutions. With over two decades of experience, it has positioned itself as a leader in Big Data implementation in Indonesia. Notable products such as YAVA247, HGrid247, and BRAJA Appliances have over 70% TKDN, supporting sectors like telecommunications, banking, and government. Its Hadoop cluster implementation for Telkomsel processes over 120 terabytes of data daily.

SOLUSI247's commitment to open-source-based product research enables the creation of relevant, cost-effective solutions. In banking, YAVA247 supports accurate and efficient predictive analytics. In government, the company developed Master Data Management systems that comply with the PDP Law. These successes are underpinned by strong customer relationship management and skilled personnel capable of handling large-scale projects. Notably, the company has seen substantial growth in Big Data and AI project value, from IDR 30 billion in 2009 to IDR 240 billion in 2023—indicating widespread adoption of its technology solutions across industries.

Despite these successes, challenges remain. Gartner (2024) reports that only 50% of tech projects meet their original objectives, often due to a lack of effective managerial strategy. Therefore, this study aims to analyze the influence of strategic collaboration, product research, human resource capabilities, and customer relationship management on the success of Big Data and AI projects at PT Dua Empat Tujuh, with government regulation as a moderating variable. The study is relevant to addressing challenges, leveraging technological opportunities, and enhancing national digital transformation efforts.

By integrating government regulation as a moderating variable and focusing on product research as a strategic factor, the study seeks to

deeply understand how these elements influence the success of Big Data and AI-based projects. Government policy provides the regulatory framework, while product research drives value creation and innovation sustainability.

Based on this phenomenon, problem, and research gap, the title of this study is: "The Influence of Strategic Collaboration, Product Research, Human Resource Capability, and Customer Relationship Management on the Success of Big Data and Artificial Intelligence Projects with Government Regulation as a Moderating Variable at PT Dua Empat Tujuh."

2. Literature Review

2.1.1. Strategic Management

Strategic management refers to a series of decisions and actions designed to achieve an organization's long-term goals by effectively leveraging external opportunities and internal resources. Lynch (2006), in his book *Corporate Strategy*, emphasizes that strategic management involves a clear long-term vision and the organization's ability to adapt to dynamic changes in the business environment. In this context, strategic management aims to create sustainable competitive value by balancing external opportunities and internal capabilities.

According to Wheelen and Hunger (2018), strategic management consists of three main stages: strategy formulation, strategy implementation, and strategy evaluation and control. Strategy formulation involves analyzing the internal and external environments of the organization to identify existing opportunities and threats, such as through a SWOT analysis. Strategy implementation entails executing strategic plans through resource management, organizational structure, and corporate culture. The evaluation and control stage ensures that the implemented strategies yield results aligned with the established objectives. This process includes performance measurement and strategic adjustments if necessary.

Porter (2008), in his concept of competitive advantage, highlights the importance of a unique strategic position for organizations to remain relevant in competitive markets. He argues that strategic management enables organizations to choose distinct activities from competitors, create value through product uniqueness, and build competitive advantages that are difficult to replicate. This is particularly relevant in the context of Big Data and Artificial Intelligence (AI) projects, where companies like PT Dua Empat Tujuh (SOLUSI247) must leverage unique technologies and strategies to ensure project success and maintain market leadership.

Additionally, Drucker (1985) underscores the importance of innovation in strategic management as a crucial element for ensuring an organization's continued relevance in ever-changing markets. Innovation, according to Drucker, includes not only new products or services but also novel approaches to organizational management. In Big Data and AI projects, strategic innovations such as developing open-source technologies and collaborating with technology partners are key to success.

Taking these theories into account, strategic management in this study serves as the foundational framework for examining the relationship between strategic factors—such as strategic collaboration, product research, human resource competence, and customer relationship management—and the success of Big Data and AI projects. The processes of formulation, implementation, and evaluation offer a comprehensive guide for effectively integrating each strategic factor to achieve organizational goals.

2.1.2. Big Data and Artificial Intelligence

The massive wave of digital transformation across various industries has positioned Big Data and Artificial Intelligence (AI) as two central pillars driving innovation, efficiency, and competitive advantage. Big Data

is characterized by the 3Vs: volume (large-scale data), variety (diverse types of structured and unstructured data), and velocity (real-time data generation and processing) (Brynjolfsson & McAfee, 2014). Davenport and Harris (2017) explain that Big Data enables organizations to analyze previously unseen patterns, support data-driven decision-making, and generate strategic value.

In technology-based projects, Big Data is not solely about managing large volumes of data but also about deriving meaningful insights from that data. McKinsey (2020) reports that companies effectively leveraging Big Data are 2.5 times more likely to become market leaders than those that do not. Technologies such as Hadoop and Spark support the management of massive data volumes efficiently, improving productivity and predictive capabilities.

AI complements Big Data by providing the capability to automatically analyze, learn, and make decisions based on sophisticated algorithms. AI encompasses technologies such as machine learning, deep learning, and natural language processing (NLP), enabling high-precision data processing at scale (Russell & Norvig, 2020). In business contexts, AI not only enhances operational efficiency but also fosters innovation in products and services tailored to customer needs (Brynjolfsson & McAfee, 2014).

The synergy between Big Data and AI lies in their mutual reinforcement: Big Data provides deep and expansive datasets, while AI offers analytic tools to uncover patterns, trends, and opportunities. Examples of Big Data and AI applications include predictive analytics for customer behavior, fraud detection in banking, and operational automation in manufacturing (Gartner, 2024). In high-tech projects like those managed by PT Dua Empat Tujuh, integrating Big Data and AI is central to achieving successful implementation and strategic objectives.

However, the successful implementation of these technologies is not without challenges. Davenport and Harris (2017) note that technological complexity, infrastructure requirements, and human resource competencies are critical success factors for Big Data and AI projects. Additionally, government regulations—such as Indonesia's Personal Data Protection Law (Law No. 27 of 2022)—provide legal frameworks that ensure data security and privacy, which are crucial aspects of Big Data management.

Overall, Big Data and AI have become strategic elements supporting digital transformation across sectors—from telecommunications to government. This study examines how these technologies, together with strategic factors such as partner collaboration, product research, and human resource competencies, can be integrated to achieve sustainable project success.

2.1.3. Strategic Collaboration

Strategic collaboration refers to a cooperative effort between two or more organizations aimed at achieving mutually beneficial goals by leveraging each party's resources and capabilities. Dyer and Singh (1998), in their *Relational View* theory, argue that strategic collaboration serves as a source of competitive advantage through the integration of unique assets and capabilities. Such collaborations often involve not only the exchange of technical knowledge but also joint innovation development, risk sharing, and operational efficiency enhancement.

2.14 Types and Approaches to Strategic Collaboration

Strategic collaboration can take various forms, including strategic alliances, joint ventures, outsourcing, and contract-based partnerships. Strategic alliances typically involve long-term cooperation without forming a new entity, while joint ventures involve the creation of a jointly owned entity for a specific project (Yoshino & Rangan, 1995). In technology-based projects such as Big Data and AI, collaboration often involves technology partners providing infrastructure, software, and technical expertise.

According to Dyer and Singh (1998), the strategic collaboration framework involves four key dimensions:

1. **Relationship-Specific Investments** Partners invest specifically in the collaboration, such as co-developing technologies.
2. **Knowledge Sharing and Transfer** Exchange of technical and managerial knowledge to foster joint innovation.
3. **Integration of Complementary Resources** Combining each party's unique capabilities to generate value that cannot be created independently.
4. **Governance-Based Partnerships** Governance mechanisms to manage conflicts and maximize synergy.

2.15 Benefits of Strategic Collaboration

The main benefits of strategic collaboration lie in increased efficiency and innovation. By sharing resources and risks, companies can reduce product development costs and accelerate time to market (Dyer & Singh, 1998). Additionally, collaboration enables access to new technologies and broader markets, enhancing competitiveness. In the context of PT Dua Empat Tujuh, strategic partnerships with local and international technology providers have enabled the development of relevant Big Data and AI solutions, such as YAVA247 and BRAJA Appliances, which feature a high level of domestic content (TKDN).

2.16 Indicators of Strategic Collaboration

To evaluate strategic collaboration in this study, the following indicators are used:

1. **Commitment to Joint Investment** The extent of resource commitment from technology partners in supporting the project.
2. **Effectiveness of Knowledge Transfer** The ability to share relevant technical and managerial knowledge.
3. **Resource Integration** The extent to which each party's capabilities are effectively combined to achieve project objectives.
4. **Governance Effectiveness** The ability to resolve conflicts and maintain productive collaboration.

These indicators form the basis for designing questionnaires and interview questions. The questionnaires may include items on the level of partner investment, frequency of technical knowledge exchange, and governance effectiveness evaluations. Interviews will focus on how strategic collaboration contributes to project success, particularly in the context of government regulation as a moderating variable.

Product research is a systematic process aimed at identifying, developing, and enhancing products to meet market needs and deliver added value to customers. Nonaka and Takeuchi (1995), in *The Knowledge-Creating Company*, describe product research as involving the exploration of both explicit and tacit knowledge within the organization to generate relevant innovations. In modern business contexts, product research also includes the adaptation of open-source technologies to develop highly efficient products with sustainable competitive value.

2.17 Processes and Approaches in Product Research

Product research can be conducted through various approaches, depending on organizational goals and needs. According to Cooper (2001), the general steps in product research include:

1. **Market Needs Identification** Using market data to understand customer needs and industry trends.
2. **Idea Generation** Developing product ideas based on customer needs analysis.
3. **Evaluation and Selection** Assessing product ideas to determine their feasibility and relevance.

4. **Prototype Development**
   Creating initial versions of the product for testing.
5. **Market Testing**
   Testing prototypes in the market to obtain customer feedback.
6. **Product Launch**
   Releasing the product to the market after development and evaluation.

In technology-based projects such as Big Data and AI, product research often leverages open-source technologies. This provides high flexibility in product development and allows companies to tailor solutions to specific customer needs without starting from scratch (Brynjolfsson & McAfee, 2014).

3. Research Methods

Research Setting and Duration

This study was conducted at PT Dua Empat Tujuh, an information technology company specializing in Big Data and Artificial Intelligence (AI) solutions, located in South Jakarta. The location was chosen due to the company's strong track record in Big Data and AI projects, as well as access to relevant informants. The research took place over a six-month period, from January to June 2024.

Methodology

This research adopts a mixed methods approach using an explanatory sequential design. The first phase involved a quantitative survey using a Likert-scale questionnaire to measure strategic collaboration, product research, human resource capability, customer relationship management, and government regulation as a moderating variable. Data were analyzed using moderated regression analysis (MRA).

The second phase included in-depth interviews with project managers and policy stakeholders to deepen insights from the quantitative phase. The qualitative data were analyzed using thematic analysis. Both sets of data were integrated to produce comprehensive findings.

Population and Sampling

The population consists of 500 employees involved in Big Data and AI projects. Using Slovin's formula with a 5% margin of error, a sample size of 222 respondents was determined using simple random sampling.

Quantitative Phase

- **Data Collection:** A Likert-scale (1 = Strongly Disagree to 5 = Strongly Agree) questionnaire measured four independent variables, one dependent variable, and one moderating variable.
- **Data Analysis:**
  - Validity and reliability tested with Exploratory Factor Analysis (EFA) and Cronbach's Alpha.
  - Normality test using Kolmogorov-Smirnov.
  - Hypothesis testing with Moderated Regression Analysis (MRA).

Regression Equation:

$Y = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \varepsilon$

Where:

- Y = Project Success
- X1 = Strategic Collaboration
- X2 = Product Innovation and Research
- X3 = Resource Capability
- X4 = Customer Relationship Management
- ε = Error Term

Moderation Model:

$Y = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \beta5M + \beta6(X1M) + \beta7(X2M) + \beta8(X3M) + \beta9(X4M) + \varepsilon$

Where:

- M = Government Regulation
- X1*M to X4*M = Interaction Effects

Significant β6 to β9 coefficients indicate a moderating effect.

Qualitative Phase

- **Data Collection:** Semi-structured interviews with project managers,

developers, and policy stakeholders to explore how government regulation affects project success.

- **Data Analysis:** Thematic analysis (Braun & Clarke, 2006) identified patterns, themes, and relationships.

Integration of Quantitative and Qualitative Data

Findings were integrated for holistic conclusions. Quantitative results identified key phenomena, which were further explored qualitatively. Triangulation ensured validity by comparing:

- Moderated regression results
- In-depth interview findings
- Relevant government policy documents

Variable Operationalization

- **Dependent Variable:** Project Success, measured by timely completion, budget efficiency, output quality, strategic goal achievement, client feedback, long-term impact, and sustainability.
- **Independent Variables:**
  - Strategic Collaboration: Joint investments, knowledge sharing, resource integration, partnership governance.
  - Product Research: Market needs, innovation speed, tech adaptation, market acceptance, value addition.
  - HR Capability: Qualifications, technical/managerial skills, self-development, employee performance.
  - Customer Relationship Management: Satisfaction, loyalty, service efficiency, CRM tech, personalization.
- **Moderating Variable:** Government Regulation, indicated by compliance (PDP, TKDN), tech transfer, product innovation impact, HR competence, and data protection.

Research Population and Sampling

Target population includes employees of PT Dua Empat Tujuh directly involved in Big Data and AI projects from project management, product research, HR/finance, and customer relationship teams. Purposive sampling criteria:

- Minimum two years' work experience
- Direct involvement in Big Data/AI projects
- Strategic decision-making roles

Proportional sampling breakdown:

- Project Management & Development Team: 156 (70%)
- Product Research & Development Team: 44 (20%)
- HR, Finance & Back Office Team: 11 (5%)
- Customer Relationship, Marketing & Sales Team: 11 (5%)

Data Collection Method

- **Quantitative:** Likert-scale questionnaires (1 to 5), measuring strategic collaboration, product research, HR capability, CRM, and government regulation. Validity via construct validity; reliability via Cronbach's Alpha (≥ 0.7).
- **Qualitative:** Semi-structured interviews with key informants, analyzed through thematic analysis.
- **Procedure:**
  - Instrument design
  - Validity and reliability testing
  - Questionnaire distribution (online/offline)
  - Interview execution
  - Data integration

Instrumentation of Variables

Nine variables: four independent, one dependent, and four moderated by government regulation. Questionnaire indicators include:

- Strategic Collaboration: Tech transfer, partner synergy, innovation sustainability

- Product Research: Market fit, development efficiency, feature innovation
- HR Capability: Competence, experience, task efficiency
- CRM: Satisfaction, loyalty, responsiveness
- Project Success: Timeliness, cost, quality, strategic impact

Data Analysis and Testing

- **Quantitative:** Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS, suitable for moderate sample sizes and complex models with moderation (Hair et al., 2017).
- **Statistical Tests:**
  - Convergent and discriminant validity
  - Reliability: Cronbach's Alpha, Composite Reliability
  - Hypothesis testing via path coefficients and p-values
  - Moderation tested via interaction terms
- **Qualitative:**
  - Transcription
  - Coding
  - Thematization

Results Interpretation

- **Quantitative:** Estimates of direct and moderating effects.
- **Qualitative:** Contextual insights on regulatory impact, project challenges, and strategy implementation.

Combined analysis yields comprehensive understanding of variable dynamics and practical implications for managing Big Data and AI projects at PT Dua Empat Tujuh, including policy recommendations. Additional tests such as bootstrapping or robustness checks may be applied based on population differences or model complexity.

4. Results and Discussion

4.1. Research Results

This chapter presents the findings of the research conducted to analyze the influence of Strategic Collaboration, Product Research, Human Resource Capability, and Customer Relationship Management on the Success of Big Data and Artificial Intelligence (AI) Projects at PT Dua Empat Tujuh, with Government Regulation as a moderating variable.

This study employed a mixed-methods approach, combining both quantitative and qualitative methods to gain a more in-depth and comprehensive understanding of the factors affecting the success of high-tech projects. The quantitative approach involved distributing questionnaires to respondents directly involved in the management and implementation of projects at PT Dua Empat Tujuh, while the qualitative approach was carried out through in-depth interviews with key informants to further explore the influence of government regulation and field dynamics.

The research findings in this chapter are systematically organized into the following subsections:

- **Overview of the Research Object**, which explains the background and profile of PT Dua Empat Tujuh as the subject of this study.
- **Respondent Description**, which outlines the characteristics of respondents based on their unit/division, work experience, and project involvement.
- **Descriptive Statistical Analysis**, which includes summary statistics for each research variable indicator.
- **Quantitative Data Analysis**, which presents an evaluation of the measurement model (outer model) and the structural model (inner model) using the Partial Least Squares - Structural Equation Modeling (PLS-SEM) approach.
- **Hypothesis Testing**, which includes statistical test results and interpretations of the relationships between variables, as well as the moderating role of government regulations.

- **Qualitative Findings Analysis**, which describes the results of in-depth interviews to enrich the quantitative findings.
- **Triangulation of Quantitative and Qualitative Findings**, which integrates the results of both approaches to provide a more comprehensive and profound conclusion.

The research findings aim to answer the formulated research questions and provide empirical contributions to the understanding of factors influencing technological project success. Additionally, the findings are expected to offer strategic insights regarding the impact of government policy on project success, particularly in the context of Big Data and AI technology implementation in Indonesia's public and private sectors.

4.1.1. Overview of the Research Object

This study was conducted at PT Dua Empat Tujuh (SOLUSI247), an information and communication technology (ICT) company that has been operating for over two decades. Widely recognized as a local pioneer in Big Data and Artificial Intelligence (AI) solutions, PT Dua Empat Tujuh develops high-tech products to support digital transformation across various sectors including telecommunications, finance, government, education, and healthcare.

1. **Vision and Commitment**
   Solusi247 is committed to being a leading driver of technological innovation in Indonesia. With the spirit of "building technology from Indonesia for Indonesia," the company strives to deliver solutions that are not only advanced but also aligned with the national context, needs, and regulations. This commitment is reflected in the allocation of 20% of its workforce for research and development activities, as well as active participation in building a national digital ecosystem through training, research collaborations, and participation in tech communities.
2. **Organizational Structure**
   Solusi247's organizational structure is led by the Chief Executive Officer (CEO) and supported by four main divisions: Marketing Sales Office (MSO), Digital Solution Office (DSO), Skill Development Office (SDO), and Business Support Office (BSO). Each division is responsible for strategic and operational aspects of the company, such as project management, HR capability development, system infrastructure and security, as well as research and product innovation. The primary focus of this study is on the Marketing & Sales Division (MSO) and the Project Management Office (PMO).
3. **Products and Specialization**
   PT Dua Empat Tujuh offers two main product lines: **YAVA247** and **BRAJA247**. YAVA247 consists of software products such as Smart & Secure Platform, AI Platform (YavAI247), and low-code development tools including HGrid247 Data Engineering, HGrid247 Analytics, and HGrid247 Deep Learning. BRAJA247 includes advanced hardware such as radar, IoT devices, and electronic systems used in defense and surveillance projects. These products have achieved a Domestic Component Level (TKDN) certification of over 70% and most are listed in the national eCatalogue. This advantage allows Solusi247 to compete with global providers in strategic technology markets.
4. **Location and Market Reach**
   Solusi247 is headquartered in Jakarta, with two operational and research centers in Bandung and Yogyakarta. The company serves more than 60 active clients across sectors such as ministries, government agencies, state-owned enterprises (SOEs), private companies, and educational institutions. Key clients include the Ministry of Defense, Directorate General of Taxes, Telkomsel, as well as regulatory bodies such as the Financial Services Authority (OJK) and the National Consumer Protection Agency (BPKN).
5. **Corporate Values**
   PT Dua Empat Tujuh upholds the following core values:

- **Continuous Innovation** – Developing local technologies that can compete globally.
- **Technological Sovereignty** – Ensuring data sovereignty and reducing reliance on foreign vendors.
- **Strategic Collaboration** – Building strong partnerships with universities, governments, and communities to develop a healthy tech ecosystem.
- **Security and Reliability** – Providing secure, robust platforms that meet international standards for national-scale projects.

With this background, PT Dua Empat Tujuh serves as a relevant and strategic research object to better understand how collaboration, research, HR capability, and customer management influence the success of high-tech projects. This study also examines the extent to which government regulations moderate these relationships in the evolving context of the national digital business ecosystem.

1. Dependent Variable: Project Success

Project success is measured through indicators such as goal achievement based on time, budget, output quality, customer satisfaction, and partner satisfaction.

- The projects I worked on were always completed on time, with a minimum score of 2.0, a maximum of 5.0, an average of 4.21, and a standard deviation of 0.76.
- Projects were completed within the predetermined budget, with a minimum score of 2.0, a maximum of 5.0, an average of 4.19, and a standard deviation of 0.79.
- The quality of project outcomes met or exceeded customer expectations, with a minimum score of 2.0, a maximum of 5.0, an average of 4.28, and a standard deviation of 0.68.
- Projects successfully achieved the company's strategic goals (ROI, improved operational performance), with a minimum score of 3.0, a maximum of 5.0, an average of 4.33, and a standard deviation of 0.67.
- I frequently received positive feedback from customers and technology partners regarding completed projects, with a minimum score of 1.0, a maximum of 5.0, an average of 4.30, and a standard deviation of 0.77.
- Projects delivered long-term strategic impacts such as increased competitiveness and continuous innovation, with a minimum score of 3.0, a maximum of 5.0, an average of 4.45, and a standard deviation of 0.65.
- Relationships with customers and partners continued after project completion, with a minimum score of 3.0, a maximum of 5.0, an average of 4.47, and a standard deviation of 0.67.

2. Independent Variables

a. Strategic Collaboration

This variable reflects the extent of PT Dua Empat Tujuh's collaboration with external partners to support project success.

- Our company is highly committed to joint investment with technology partners, with a minimum score of 1.0, a maximum of 5.0, an average of 4.43, and a standard deviation of 0.71.
- Knowledge transfer with partners in projects is conducted effectively, with a minimum score of 3.0, a maximum of 5.0, an average of 4.31, and a standard deviation of 0.69.
- Resource integration with partners is carried out well to achieve shared goals, with a minimum score of 2.0, a maximum of 5.0, an average of 4.34, and a standard deviation of 0.70.
- Partnership governance in projects runs effectively and efficiently, with a minimum score of 2.0, a maximum of 5.0, an average of 4.29, and a standard deviation of 0.72.

b. Product Research

Product research measures how well the organization innovates and develops based on market needs.

- The company understands market needs before developing new products, with a minimum score of 2.0, a maximum of 5.0, an

average of 4.35, and a standard deviation of 0.77.

- Product innovation in our projects proceeds quickly and adapts well to change, with a minimum score of 2.0, a maximum of 5.0, an average of 4.32, and a standard deviation of 0.80.
- The latest open-source technology is used in product development, with a minimum score of 3.0, a maximum of 5.0, an average of 4.44, and a standard deviation of 0.65.
- The products produced have received good market acceptance, with a minimum score of 1.0, a maximum of 5.0, an average of 4.24, and a standard deviation of 0.75.
- The product research conducted significantly contributes to added value for the company and customers, with a minimum score of 1.0, a maximum of 5.0, an average of 4.32, and a standard deviation of 0.72.

c. Human Resource Capability

This variable measures internal capabilities in managing high-tech-based projects.

- The project team has the appropriate qualifications and certifications to run Big Data & Artificial Intelligence projects, with a minimum score of 2.0, a maximum of 5.0, an average of 4.47, and a standard deviation of 0.64.
- Team members possess strong technical skills in technologies such as Hadoop, data analytics, and big data processing, with a minimum score of 3.0, a maximum of 5.0, an average of 4.58, and a standard deviation of 0.59.
- Managerial skills in the project team (planning, coordination, execution) are excellent, with a minimum score of 1.0, a maximum of 5.0, an average of 4.33, and a standard deviation of 0.71.
- The company provides training and mentoring to support HR competency development, with a minimum score of 1.0, a maximum of 5.0, an average of 4.24, and a standard deviation of 0.85.
- Employee performance in projects is assessed based on time efficiency and quality of work results, with a minimum score of 2.0, a maximum of 5.0, an average of 4.43, and a standard deviation of 0.68.

d. Customer Relationship Management

This variable refers to the company's efforts in maintaining communication and service with customers during and after the project.

- Customers are satisfied with the delivered project results, with a minimum score of 3.0, a maximum of 5.0, an average of 4.44, and a standard deviation of 0.63.
- Customers are likely to continue using the company's services after project completion, with a minimum score of 1.0, a maximum of 5.0, an average of 4.29, and a standard deviation of 0.79.
- Customer service in the company is efficient and responsive, with a minimum score of 3.0, a maximum of 5.0, an average of 4.39, and a standard deviation of 0.67.
- The company uses CRM technology to enhance the customer experience, with a minimum score of 2.0, a maximum of 5.0, an average of 4.24, and a standard deviation of 0.78.
- The customer experience in interacting with the company is highly personalized according to their needs, with a minimum score of 2.0, a maximum of 5.0, an average of 4.33, and a standard deviation of 0.70.

3. Moderating Variable: Government Regulation

Government regulation acts as a moderating variable in the relationship between strategic factors and project success. Indicators include the effectiveness of implementing TKDN regulations, the Personal Data Protection Act (PDP Law), and support for local products.

a. Moderating Variable: Government Regulation x Human Resource Capability

- Employees involved in projects have certifications according to competency standards (e.g., SKKNI), with a minimum score of 2.0, a maximum of 5.0, an average of 4.17, and a standard deviation of 0.85.
- The company invests in HR training and development to comply with regulations, with a minimum score of 1.0, a maximum of 5.0, an average of 4.25, and a standard deviation of 0.86.
- Operational efficiency of HR has improved with the presence of clear regulations, with a minimum score of 2.0, a maximum of 5.0, an average of 4.28, and a standard deviation of 0.77.
- HR can adapt quickly to changes in technology regulations, with a minimum score of 2.0, a maximum of 5.0, an average of 4.32, and a standard deviation of 0.73.

b. Moderating Variable: Government Regulation x Strategic Collaboration

- The company complies with TKDN (Local Content Requirement) regulations in project partnerships, with a minimum score of 2.0, a maximum of 5.0, an average of 4.53, and a standard deviation of 0.64.
- Government regulations support the success of technology transfer in strategic collaboration, with a minimum score of 2.0, a maximum of 5.0, an average of 4.31, and a standard deviation of 0.77.
- Customer data protection complies with the Personal Data Protection Act (PDP), with a minimum score of 2.0, a maximum of 5.0, an average of 4.48, and a standard deviation of 0.63.
- Regulations influence partner selection in company projects, with a minimum score of 2.0, a maximum of 5.0, an average of 4.29, and a standard deviation of 0.68.
- The company's collaboration strategy is flexible in adapting to government regulations, with a minimum score of 1.0, a maximum of 5.0, an average of 4.26, and a standard deviation of 0.74.

c. Moderating Variable: Government Regulation x Customer Relationship Management

- The company ensures that customer service complies with data privacy regulations (PDP Law), with a minimum score of 2.0, a maximum of 5.0, an average of 4.46, and a standard deviation of 0.70.
- Customers feel more confident about the security of the data provided to the company, with a minimum score of 2.0, a maximum of 5.0, an average of 4.41, and a standard deviation of 0.70.
- Regulations do not hinder customer service but instead enhance customer trust, with a minimum score of 3.0, a maximum of 5.0, an average of 4.42, and a standard deviation of 0.65.
- The company integrates customer data in accordance with applicable regulations, with a minimum score of 2.0, a maximum of 5.0, an average of 4.43, and a standard deviation of 0.67.

d. Moderating Variable: Government Regulation x Product Research

- The products developed comply with applicable TKDN regulations, with a minimum score of 3.0, a maximum of 5.0, an average of 4.49, and a standard deviation of 0.62.
- Our product research complies with data privacy regulation standards (PDP Law), with a minimum score of 2.0, a maximum of 5.0, an average of 4.47, and a standard deviation of 0.69.
- Regulations do not hinder product innovation but instead drive quality improvement, with a minimum score of 2.0, a maximum of 5.0, an average of 4.38, and a standard deviation of 0.72.
- Regulations impact data collection methods and prototype development, with a minimum score of 3.0, a maximum of 5.0, an average of 4.32, and a standard deviation of 0.69.

- Products developed in accordance with regulations have received good market acceptance, with a minimum score of 2.0, a maximum of 5.0, an average of 4.28, and a standard deviation of 0.75.

4.1.4. Quantitative Data Analysis

Quantitative data analysis in this study employed the **Partial Least Squares - Structural Equation Modeling (PLS-SEM)** approach to evaluate the relationships among latent variables defined in the conceptual model. The analysis began with the assessment of the **measurement model (outer model)** to ensure that the indicators used in the questionnaire had adequate validity and reliability.

4.1.4.1. Evaluation of the Measurement Model (Outer Model)

The measurement model used in this study is reflective, and its evaluation refers to the guidelines by **Hair et al. (2021)**. The assessment of reflective measurement models includes two main aspects: **convergent validity** and **discriminant validity**.

To fulfill the requirements of **convergent validity**, indicators must meet the following criteria:

- Outer loading ≥ 0.60
- Composite reliability ≥ 0.70
- Cronbach's alpha ≥ 0.70
- Average Variance Extracted (AVE) ≥ 0.50

Discriminant validity is assessed through several approaches:

- **Fornell-Larcker criterion**, where the square root of the AVE for each construct must be greater than the correlation between that construct and other constructs.
- **Heterotrait-Monotrait Ratio (HTMT)** value should ideally be below 0.90.
- **Cross-loadings analysis**, where each indicator must have the highest correlation with its associated construct (value > 0.70) compared to other constructs.

The results of the convergent validity test, including values for outer loadings, Cronbach's alpha, composite reliability, and AVE for each indicator, are presented in detail in Table 4.7**.**

Table 4.7
Results of Convergent Validity Test

Measurement Item	Outer Loadings	Cronbach's Alpha	Composite Reliability	AVE
Strategic Collaboration (X1)	X1.1 0.58	0.791	0.823	0.622
	X1.2 0.84			
...	...	...	...	...

(Full table contents follow as per original)

Source: SmartPLS Output (processed data, 2025)

The first step in the quantitative model analysis is to evaluate the measurement quality of each construct. In this study, **Confirmatory Factor Analysis (CFA)** is applied since all constructs were developed based on established theory and prior research. A key requirement in evaluating a reflective measurement model is to ensure each indicator significantly contributes to its respective construct. According to **Hair et al. (2019)**, an indicator is considered acceptable if its **outer loading ≥ 0.70**. Indicators below this threshold indicate poor representation and are better removed, especially in confirmatory studies.

Hair et al. (2021) also noted that in reflective models, removing indicators will not change the meaning of the construct as long as the remaining indicators still sufficiently represent it. Therefore, removing such indicators is part of the **model refinement** process to enhance measurement quality. Based on the convergent validity test results in Table 4.7, **eight indicators** with outer loadings below

0.70 were removed from the model. These are summarized in Table 4.8:

Table 4.8
Removed Indicators

Measurement Item	Indicator	Outer Loadings
X1.1	Commitment to joint investment with technology partners	0.58
X2.5	Product research contributes value to the company and customers	0.67
...	...	...

(Full table contents follow as per original)
Source: SmartPLS Output (processed data, 2025)

After removing the indicators that did not meet the outer loading threshold, the next step was to evaluate the **convergent validity and internal reliability** of each construct. This ensures that the remaining indicators accurately and consistently reflect the constructs they are intended to measure.

Convergent validity is assessed using three key statistical measures:

1. **Outer Loading** – the strength of the relationship between an indicator and its construct; ideal value: ≥ 0.70.
2. **Average Variance Extracted (AVE)** – the proportion of variance in indicators explained by the construct; recommended value: ≥ 0.50.
3. **Internal Reliability**, measured by:
   - **Cronbach's Alpha** – consistency among indicators.
   - **Composite Reliability (CR)** – considered more accurate as it does not assume equal indicator weights. Recommended value for both: ≥ 0.70 (Hair et al., 2021).

The post-removal results for outer loading, Cronbach's alpha, composite reliability, and AVE for each indicator are detailed in Table 4.9.

Table 4.9
Post-Removal Convergent Validity Results

Measurement Item	Outer Loadings	Cronbach's Alpha	Composite Reliability	AVE
Strategic Collaboration (X1)	X1.2 0.85	0.83	0.83	0.74
	X1.3 0.87			
	X1.4 0.87			
...	...	...	...	...

(Full table contents follow as per original)
Source: SmartPLS Output (processed data, 2025)

After removing the indicators with outer loadings below 0.70, the next step was to test the **convergent validity and internal reliability** of each construct. The goal of this stage is to confirm that each construct is measured consistently and validly by the selected indicators. Convergent validity is assessed through the following indicators: **outer loading, Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE)**. According to **Hair et al. (2021)**, a construct is considered to meet convergent validity if all indicators have outer loading ≥ 0.70, Cronbach's Alpha and CR ≥ 0.70, and AVE ≥ 0.50.

The following are the convergent validity and reliability results for each construct:

a Strategic Collaboration (X1)

This construct is measured by three indicators, all with outer loadings above 0.70, indicating strong reflection of the construct:

- **X1.2**: "Collaboration with strategic technology partners supports the success of

big data and AI projects"
Outer loading: **0.85**

- **X1.3**: "The company actively engages in mutually beneficial technology partnerships"
  Outer loading: **0.87**
- **X1.4**: "Long-term collaboration with strategic partners has been well established and managed"
  Outer loading: **0.87**

b. Strategic Collaboration (X1)

All indicators have outer loading values above 0.70, indicating that each indicator strongly and significantly reflects the Strategic Collaboration construct. This suggests that the indicators are of high quality in measuring the strategic collaboration aspect within the company. In terms of internal reliability, this construct has a Cronbach's Alpha of 0.83 and Composite Reliability of 0.83. Both values exceed the minimum threshold of 0.70, as recommended by Hair et al. (2021), indicating high internal consistency among the indicators in measuring the same construct. Furthermore, the Average Variance Extracted (AVE) for this construct is 0.74, well above the minimum threshold of 0.50. This indicates that the Strategic Collaboration construct explains more than 74% of the variance of its indicators, signifying excellent convergent validity. Overall, the Strategic Collaboration construct (X1) demonstrates high convergent validity and strong internal reliability, making it a reliable measure for use in the next stage of the structural model analysis.

c. Product Research (X2)

The Product Research construct (X2) is measured using three indicators, all of which have outer loading values ≥ 0.70, indicating strong representation of the construct. Details are as follows:

- X2.2: "The company actively conducts research to develop products based on big data and AI technology"
  Outer loading: 0.87
- X2.3: "The research process is conducted collaboratively and in a structured manner"
  Outer loading: 0.72
- X2.4: "Research products have been implemented in real projects"
  Outer loading: 0.81

All indicators surpass the recommended outer loading threshold of 0.70, indicating significant contribution in explaining the Product Research variable.
The construct shows a Cronbach's Alpha of 0.81 and Composite Reliability of 0.83, exceeding the minimum standard of 0.70, indicating high internal consistency among the three indicators.
The AVE value is 0.64, above the threshold of 0.50, meaning more than 64% of indicator variance is explained by the latent Product Research variable.
Thus, Product Research (X2) has sufficient measurement quality in terms of validity and reliability, and can be reliably used in the structural model analysis.

d. Human Resource Capability (X3)

This construct is measured using three indicators, each with outer loading values above 0.70, indicating strong and consistent representation:

- X3.3: "HR involved in the project possess technical skills relevant to big data and AI"
  Outer loading: 0.78
- X3.4: "HR can apply new technology quickly and efficiently in projects"
  Outer loading: 0.80
- X3.5: "The company has trained and certified HR for implementing big data and AI projects"
  Outer loading: 0.83

These indicators meet the ≥ 0.70 standard, significantly contributing to the Human Resource Capability construct.
The construct has Cronbach's Alpha and Composite Reliability values of 0.80, both above 0.70, indicating good internal consistency.
The AVE is 0.62, above the 0.50 threshold,

showing that over 62% of the indicator variance is explained by the construct. Therefore, the Human Resource Capability construct (X3) has very good convergent validity and internal reliability for use in further structural model analysis.

e. Customer Relationship Management (X4)

This construct is measured using five indicators, all with outer loading values above 0.70, indicating valid reflective measurement:

- X4.1: "The company has an effective communication system with project customers" — 0.76
- X4.2: "The project team responds to customer needs and feedback in a timely manner" — 0.76
- X4.3: "Customer satisfaction is an important part of project evaluation" — 0.82
- X4.4: "The company provides ongoing technical support to customers" — 0.73
- X4.5: "Long-term partnerships with customers are actively maintained" — 0.76

All indicators show strong relationships with the Customer Relationship Management construct.

The construct has a Cronbach's Alpha and Composite Reliability of 0.83, indicating excellent internal consistency.
The AVE is 0.59, above the 0.50 minimum, indicating that the construct explains over 59% of its indicators' variance.
Thus, the Customer Relationship Management construct (X4) has strong convergent validity and internal reliability and is ready for structural model testing.

f. Government Regulation on Strategic Collaboration (Z1)

This construct is measured using three indicators, all with outer loadings > 0.70:

- Z1.2: "Government regulations support collaboration with strategic partners" — 0.84
- Z1.4: "Government policies facilitate synergy between the company and other institutions" — 0.86
- Z1.5: "The company adapts collaboration models based on current regulations" — 0.81

These indicators effectively reflect perceptions of government regulatory support.

Cronbach's Alpha and Composite Reliability are both 0.79, above the 0.70 threshold, indicating consistent internal measurement.
The AVE is 0.70, demonstrating excellent convergent validity.
Thus, the Z1 construct is valid and reliable for use in moderating relationship testing in the structural model.

g. Government Regulation on Product Research (Z2)

Measured using four indicators, all with outer loadings above 0.70:

- Z2.2: "Regulations encourage innovative product research" — 0.75
- Z2.3: "Policies contribute to developing a technology research roadmap" — 0.87
- Z2.4: "Regulations support resource allocation for AI and big data-based research" — 0.82
- Z2.5: "Incentive programs encourage research investment" — 0.85

All indicators significantly contribute to the Z2 construct.
Cronbach's Alpha and Composite Reliability are both 0.84.
AVE is 0.68, indicating strong convergent validity.
Thus, this construct is reliable and valid for use in moderation analysis within the structural model.

h. Government Regulation on Human Resource Capability (Z3)

Measured using four indicators with outer loading values ≥ 0.80:

- Z3.1: "Regulations promote technical competency development" — 0.84
- Z3.2: "Policies support training and certification for tech project HR" — 0.88

- Z3.3: "Regulations standardize HR qualifications in AI and big data" — 0.85
- Z3.4: "Regulations ensure continuous HR capacity development" — 0.81

Cronbach's Alpha and Composite Reliability are both 0.87.
AVE is 0.71, showing excellent convergent validity.
Thus, the construct is valid and reliable for deeper structural model analysis.

i. Government Regulation on Customer Relationship Management (Z4)

Measured using four indicators with outer loadings > 0.70:

- Z4.1: "Regulations guide long-term customer relationship building" — 0.82
- Z4.2: "Policies encourage improved customer satisfaction" — 0.86
- Z4.3: "Public service standards contribute to good customer relationship management" — 0.85
- Z4.4: "The company adjusts customer strategies in line with regulations" — 0.86

Cronbach's Alpha is 0.87 and Composite Reliability is 0.88, indicating strong internal consistency.
AVE is 0.72, reflecting high convergent validity.
Thus, this construct is robust and suitable for use in structural model analysis.

j. Project Success (Y1)

Measured using five indicators with outer loadings > 0.70:

- Y1.2: "Project meets functional goals aligned with user needs" 0.77
- Y1.3: "Project is completed on schedule" 0.77
- Y1.4: "Project stays within budget" — 0.81
- Y1.5: "Project adds strategic value to the organization" 0.78
- Y1.6: "Overall stakeholder satisfaction is high" 0.75

All indicators contribute strongly to explaining project success. Cronbach's Alpha is 0.83 and Composite Reliability is 0.84, indicating high internal consistency.

AVE is 0.60, meaning 60% of indicator variance is explained by the latent construct. Thus, the Project Success construct (Y1) demonstrates adequate convergent validity and internal reliability and is suitable for further causal relationship testing in the structural model.

Outer Loading Results are presented in the following figure:

Overall, the test results indicate that all constructs in this study meet the recommended criteria for convergent validity and internal reliability. Thus, these constructs can be used for further testing in the structural model.

After evaluating convergent validity, the next step is to evaluate discriminant validity through the Fornell-Larcker test, HTMT (Heterotrait-Monotrait Ratio), and cross-loadings. The results of discriminant validity evaluation are presented in the following tables:

Table 4.10
Fornell-Larcker Test Results

	Project Success	HR Competency	Strategic Collaboration	Customer Relationship Management	Government Regulation HR	Government Regulation Strategic Collaboration	Government Regulation Customer Relationship	Government Regulation Product Research	Product Research

Project Success	0.776								
HR Competency	0.596	0.787							
Strategic Collaboration	0.630	0.559	0.863						
Customer Relationship Mgmt.	0.663	0.691	0.648	0.769					
Gov. Regulation HR	0.624	0.727	0.587	0.710	0.844				
Gov. Regulation Strategic Collab.	0.572	0.632	0.593	0.664	0.661	0.838			
Gov. Regulation CRM	0.544	0.642	0.539	0.648	0.704	0.656	0.847		
Gov. Regulation Product Research	0.595	0.639	0.527	0.652	0.721	0.712	0.714	0.825	
Product Research	0.587	0.668	0.605	0.709	0.696	0.656	0.614	0.700	0.797

Source: SmartPLS Output (Processed Data, 2025)

Discriminant validity testing is conducted to ensure that each construct in the model truly measures a distinct concept and does not overlap with one another. One commonly used method for this purpose is the **Fornell-Larcker Criterion**, developed by Fornell and Larcker (1981). According to this method, a construct is said to have good discriminant validity if the square root of the AVE (shown in the table as bold diagonal values) is greater than the correlations between that construct and the others (off-diagonal values).

Based on the Fornell-Larcker test results, it can be concluded that all constructs meet the discriminant validity criteria. This is evident from:

- The **Project Success** construct (Y1) has a square root of AVE of 0.776, which is higher than its correlation values with other constructs, such as HR Competency

(0.596), Strategic Collaboration (0.630), and others.

- The **HR Competency** construct (X3) has a square root of AVE of 0.787, greater than its highest correlation with another construct, which is 0.727 with Government Regulation HR (Z3).
- The **Strategic Collaboration** construct (X1) shows a square root of AVE of 0.863, significantly higher than all its correlation values, such as 0.648 with Customer Relationship Management or 0.632 with Government Regulation Strategic Collaboration.
- Similarly, other constructs such as **Product Research** (X2) with a square root of AVE of 0.797, **Government Regulation Product Research** (Z2) with 0.825, **Government Regulation CRM** (Z4) with 0.847, and so forth.

The consistent difference between diagonal values and the off-diagonal correlation values indicates that each construct possesses unique characteristics and does not conceptually overlap. This is crucial in PLS-SEM structural models as it ensures that relationships among variables can be interpreted accurately without measurement bias caused by construct similarity.

Thus, based on the Fornell-Larcker criterion, it can be concluded that the discriminant validity of all constructs in this model has been met, and the measurement of each variable can be considered specific to its intended construct.

Table 4.11
HTMT Test Results

	Project Success	HR Competency	Strategic Collaboration	CRM	Gov. Regulation HR	Gov. Regulation Strategic Collaboration	Gov. Regulation CRM	Gov. Regulation Product Research	GR x SC	GR x PR	GR x HR	GR x CRM
Project Success												
HR Competency	0.729											
Strategic Collaboration	0.756	0.683										
CRM	0.793	0.853	0.783									
Gov. Regulation HR	0.731	0.878	0.691	0.846								

Gov. Regulation SC	0.700	0.795	0.732	0.826	0.798							
Gov. Regulation CRM	0.633	0.773	0.633	0.765	0.814	0.792						
Gov. Regulation PR	0.707	0.781	0.628	0.783	0.843	0.874	0.836					
Product Research	0.702	0.821	0.725	0.859	0.825	0.807	0.726	0.837				
GR SC x SC	0.208	0.324	0.417	0.319	0.308	0.327	0.286	0.215	0.307			
GR PR x PR	0.278	0.426	0.333	0.398	0.483	0.402	0.463	0.527	0.566	0.475		
GR HR x HR	0.246	0.594	0.329	0.488	0.588	0.383	0.420	0.434	0.441	0.417	0.513	
GR CRM x CRM	0.321	0.461	0.301	0.536	0.446	0.413	0.539	0.439	0.378	0.484	0.582	0.603

Source: SmartPLS Output (Processed Data, 2025)

In addition to the Fornell-Larcker method, the discriminant validity test in this study is further strengthened using the **Heterotrait-Monotrait Ratio (HTMT)** approach. HTMT is considered a more sensitive method for detecting discriminant issues between constructs and is recommended by Henseler et al. (2015) as a supplement or alternative to the Fornell-Larcker Criterion.

In HTMT testing, a construct is said to have adequate discriminant validity if the HTMT value between constructs does not exceed 0.90. Values above 0.90 indicate potential discrimination issues, where two constructs may be measuring the same concept.

Based on the data processing results, all HTMT values between constructs in this study are below the 0.90 threshold. For example:

- The HTMT value between **Project Success** and **Customer Relationship Management** is 0.793
- Between **HR Competency** and **Government Regulation HR** is 0.878
- Between **Product Research** and **Government Regulation Product Research** is 0.837
- Even for moderation interaction constructs, such as **Government Regulation Strategic Collaboration x Strategic Collaboration**, the value is only 0.417, far below the threshold.

4.1.4.2. Evaluation of the Structural Model (Inner Model)

The evaluation of the structural model aims to assess the strength of the relationships

between constructs in the research model and to test the formulated hypotheses. In the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach, this process is conducted to determine the extent to which exogenous constructs explain the endogenous variables, as well as to ensure there is no bias due to overly strong or irrelevant inter-construct relationships.

This structural model evaluation consists of three main aspects:

- **Multicollinearity test** among constructs using the inner Variance Inflation Factor (VIF), where the ideal value is < 5.
- **Significance testing** of the relationships between variables through path coefficient estimation, including the calculation of t-values and p-values to test hypotheses.
- **Effect size analysis** (f^2) to measure the strength of each construct's influence on the dependent variable.
- **Model fit assessment** using indicators such as the Standardized Root Mean Square Residual (SRMR).

Additionally, the **Adjusted R-square** is used to determine how well the exogenous constructs explain the variance in the endogenous construct within the model. This evaluation is crucial to assess the model's predictive quality and relevance in explaining the studied phenomenon (Hair et al., 2021; Henseler et al., 2016).

a. Multicollinearity Test (Inner VIF)

One important assumption in structural modeling is the absence of multicollinearity among the exogenous constructs (independent variables) that lead to the endogenous construct (dependent variable). Multicollinearity indicates a very high correlation between two or more predictor constructs, which can distort the estimation of path coefficients and lead to inaccurate interpretations (Hair et al., 2021).

To detect signs of multicollinearity in PLS-SEM, the **Variance Inflation Factor (VIF)** is used. According to Hair et al. (2021), a good VIF value is < 5. VIF values between 5–10 indicate moderate multicollinearity, and values above 10 suggest high multicollinearity that needs immediate attention.

Based on the VIF analysis results in this model, all constructs influencing the **Project Success (Y1)** variable have VIF values well below the critical threshold, as shown in the table below:

Table 4.13

Inner VIF Values

Constructs	Project Success
Human Resource Capability	2.837
Strategic Collaboration	2.203
Customer Relationship Management	3.413
Government Regulation x Human Resource Capability	3.634
Government Regulation x Strategic Collaboration	2.701
Government Regulation x Customer Relationship Management	2.891
Government Regulation x Product Research	3.320
Product Research	3.212
Gov. Regulation x CRM × CRM	2.527
Gov. Regulation x Product Research × Product Research	2.214
Gov. Regulation x Human Resource Capability × HR Capability	2.173
Gov. Regulation x Strategic Collaboration × Strategic Collaboration	1.662

Source: SmartPLS Output (Processed Data, 2025)

Table 4.13 indicates that none of the constructs in this model have VIF values exceeding 5. Therefore, it can be concluded that there are no signs of multicollinearity in the developed structural model. This indicates that each construct has independent predictive

capability and does not excessively overlap with others. This validity provides confidence that the path coefficient estimates in the model are stable and unbiased due to inter-construct correlations. As a result, the hypothesis testing outcomes can be interpreted accurately and meaningfully to support the theoretical and practical conclusions of this research.

b. Coefficient of Determination (Adjusted R-Square)

The R-square value is used to measure how much the independent variables in the model can explain the variance of the dependent variable. For the **Project Success (Y1)** construct, the result is as follows:

Table 4.14

R-Square Test Results

	R-square	Adjusted R-square
Project Success	0.582	0.558

Source: SmartPLS Output (Processed Data, 2025)

This value shows that 58.2% of the variation in Project Success can be explained by the combination of Strategic Collaboration, Product Research, Human Resource Capability, Customer Relationship Management, and their respective regulatory moderating effects. According to Hair et al. (2021), this is categorized as substantial, indicating a strong explanatory power of the model.

c. Effect Size Test (f^2)

Table 4.15

F Square Test Results

Construct Relationship	f-square
Human Resource Capability → Project Success	0.023
Strategic Collaboration → Project Success	0.082
Customer Relationship Management → Project Success	0.033
Gov. Regulation x Human Resource Capability → Project Success	0.030
Gov. Regulation x HR Capability × HR Capability → Project Success	0.052
Gov. Regulation x Strategic Collaboration → Project Success	0.000
Gov. Regulation x Strategic Collaboration × Strategic Collaboration → Project Success	0.002
Gov. Regulation x Customer Relationship Management → Project Success	0.003
Gov. Regulation x CRM × CRM → Project Success	0.008
Gov. Regulation x Product Research → Project Success	0.016
Gov. Regulation x Product Research × Product Research → Project Success	0.003
Product Research → Project Success	0.001

Source: SmartPLS Output (Processed Data, 2025)

The f-square analysis is conducted to evaluate the relative contribution of each construct to the dependent variable. The results show that:

- **Strategic Collaboration → Project Success**: $f^2 = 0.082$ (medium effect)
- **Human Resource Capability → Project Success**: $f^2 = 0.023$ (small effect)
- **Customer Relationship Management → Project Success**: $f^2 = 0.033$ (small effect)
- **Product Research → Project Success**: $f^2 = 0.001$ (very small/insignificant)

- **Moderation: Gov. Regulation x HR Capability → Project Success**: f^2 = 0.052 (small to medium effect)
- **Other regulation interactions (Z1a, Z2a, Z4a)**: f^2 < 0.01 (insignificant)

This interpretation shows that Strategic Collaboration contributes the most significantly to Project Success, while constructs such as Product Research and most regulatory moderation effects have minimal or insignificant impact on the dependent variable.

Product Research

In the discussion on product research, each informant expressed strong views on the importance of innovation and market understanding in developing Big Data & Artificial Intelligence solutions.

Mr. Deni Yulian, as the CTO, emphasized that research and development (R&D) is no longer optional but essential. He explained that every new feature or solution developed by PT Dua Empat Tujuh always begins with a specific market need. According to him, the technology team actively conducts observations and trials of various technological approaches, including open-source-based solutions, before ultimately deciding to develop an in-house product. He also added that input from the business and sales teams is crucial so that innovations are practical and not merely experimental.

Mr. Oktanto Dedi Winarko reinforced this by stating that a product's success is inseparable from the right timing and sensitivity to market dynamics. He acknowledged that the innovation process in the company is driven by a market sensing approach— the ability to quickly respond to changes in customer needs and market opportunities. In the interview, he mentioned that innovation at PT Dua Empat Tujuh often emerges from a combination of field insights and business intuition from leaders, not merely from literature reviews or technical benchmarking.

Ms. Sri Wulandari added from the HR perspective that product research also requires internal readiness, particularly in skills and flexibility of thought. She noted that not all staff are used to working in a dynamic and experimental environment. Therefore, the company actively promotes cross-functional training and discussions to ensure the spirit of innovation is evenly spread, not just confined to the technology division.

Meanwhile, Mr. Budi Susanto stressed the importance of *relevance* in developed products. He pointed out that customers don't only assess technology based on its sophistication, but also on how well it aligns with their needs and local policies. In this context, he sees regulations such as the Personal Data Protection Law (PDP) and Local Content Requirements (TKDN) not as obstacles but as guidelines that provide direction in product development. "By complying with regulations, our product gains stronger bargaining power in the national market," he stated.

All four informants agreed that successful product research combines market acuity, innovation agility, and regulatory compliance. They also emphasized the importance of a continuous research process, not just for creating new products but also for refining existing ones in response to evolving needs and challenges.

2. Human Resource (HR) Capabilities

In interviews regarding the role of HR in the success of Big Data and AI projects, all informants agreed that workforce competency and readiness are foundational. Projects run by the company require personnel who are not only technically proficient but also agile in adapting to rapidly changing technologies and business models.

Ms. Sri Wulandari, as the HR Manager, explained that the biggest challenge is not recruitment alone, but retaining and continuously developing existing talent. She mentioned that PT Dua Empat Tujuh actively conducts both internal and external technical training, including sending staff to certifications or workshops relevant to project needs. However, she also emphasized the importance

of strengthening soft skills such as communication, teamwork, and adaptability—often critical success factors in multi-stakeholder projects.

She added that talent regeneration is also a major concern. "We cannot rely on just one or two experts. HR must be comprehensively developed from entry-level to managerial levels so that the company has resilience and sustainability in the long term," she said.

Mr. Deni Yulian offered a technical perspective. He stated that Big Data and AI projects require a wide range of skills—from programming and large-scale data processing to machine learning algorithm understanding. He acknowledged that it's difficult to find talent who possess all these competencies, which is why the company often forms cross-functional teams to complement one another.

Interestingly, Mr. Oktanto Dedi Winarko also highlighted loyalty and work culture. According to him, HR capability should not be judged solely on technical grounds but also on how individuals grow with the company. He believes a positive work climate, sense of ownership, and involvement in the company's vision foster greater motivation and contributions from employees.

From the marketing side, Mr. Budi Susanto emphasized that HR in sales and implementation must also understand the technology—at least conceptually. "When talking to clients, we need to know what we're selling and how the solution addresses their problems. So, it's not just about selling but also about understanding the content," he said.

From these perspectives, it's evident that the company prioritizes HR development as a strategic focus. Training, certification, and supportive managerial approaches are implemented to ensure teams can meet the challenges of complex projects. Moreover, a culture of collaboration and continuous learning is fundamental in building a solid, competitive team.

3. Customer Relationship Management

When asked how the company manages relationships with clients, the informants indicated that the approach is not merely transactional but focuses on sustainability and long-term trust.

Mr. Budi Susanto, as the Account Director directly interacting with clients, explained that customer satisfaction is key in Big Data and AI projects, which are usually long-term and complex. He stated that clients in this sector have high expectations since they rely on technology solutions to support their core business processes. Therefore, intensive communication, product roadmap clarity, and accurate implementation are crucial.

He added that the relationship does not end after project completion. On the contrary, the company actively provides after-sales support—such as training, monitoring, and regular evaluations. "We want our clients to feel like they're building a long-term relationship with a trusted partner, not just buying a product," he said.

Mr. Deni Yulian added from a technology standpoint that the company has started to implement an internal CRM system, although it's still being refined. The system is used to track client interaction histories, monitor project-related issues, and record user feedback. The goal is to give all teams—technical and business—a complete picture of each client relationship.

Mr. Oktanto Dedi Winarko raised the issue of client trust, especially regarding data management. He acknowledged that Big Data projects often involve access to sensitive client data. Therefore, data security and privacy assurances are a key part of the customer relationship strategy. He noted that compliance with regulations like the PDP Law is not just about adherence but also about building credibility.

Ms. Sri Wulandari also highlighted the importance of involving HR in customer relations. She explained that implementation and support teams must have not only technical

skills but also interpersonal communication skills. "When clients face issues, a quick and empathetic response can be more impactful than a perfect but delayed technical solution," she said.

Overall, customer management at PT Dua Empat Tujuh appears highly personalized and strategic—focusing not only on successful technology implementation but also on creating positive client experiences. This aligns with the company's values of sustainability, trust, and client proximity, particularly in a landscape of rapidly evolving technologies and increasingly strict regulations.

4. Government Regulations

Regulatory issues emerged as a key factor shaping the company's strategy in developing and executing Big Data and AI projects. The informants had varied views, but all agreed that regulations—especially those related to data and local content—are not merely challenges but also opportunities.

Mr. Oktanto Dedi Winarko, as CEO, stated that regulations such as the Personal Data Protection Law (PDP) and Local Content Requirements (TKDN) do indeed present pressure. However, he believes these regulations can drive the company to be more competitive, particularly by promoting locally developed solutions. He explained that PT Dua Empat Tujuh's status as a local company is actually an advantage. "Many clients in the public and government sectors prefer local providers because they know their data stays within the country," he said.

Mr. Deni Yulian, as CTO, stressed the importance of aligning technology architecture with current regulations. During development, the tech team considers how to ensure systems comply with rules such as data residency and system security. He admitted that ambiguities sometimes exist—especially with new technologies like AI and cloud platforms. That's why the company maintains communication with regulators and prepares various compliance documents to show commitment.

From an HR standpoint, Ms. Sri Wulandari said regulations also influence recruitment and training policies. For example, TKDN policies encourage the company to prioritize local talent and strengthen internal competencies. She sees this as an opportunity to create a more inclusive and sustainable work ecosystem. She also noted that good regulations promote better HR documentation and certification systems.

Meanwhile, Mr. Budi Susanto focused on market perspectives. He believes that regulations like the PDP Law can actually strengthen customer trust in PT Dua Empat Tujuh's products. However, he also emphasized the need for ongoing customer education to help them understand that compliance protects their interests. "Sometimes clients see regulations as a burden, but they're actually meant to protect them. That's where we come in to explain the value of compliance," he said.

Overall, the interviews suggest that government regulations are not seen as limitations, but as a compass guiding the company's sustainable and responsible growth. Although implementation can be challenging, all informants agreed that regulatory compliance is a key part of staying relevant, trusted, and competitive amid rapid technological development and complex market demands.

4. Success of Big Data & AI Projects

When discussing what defines the success of Big Data and Artificial Intelligence (AI) projects at PT Dua Empat Tujuh, the informants conveyed that success is not merely about meeting technical targets or completing projects on time. More importantly, success is measured by the tangible impact on users, organizations, and the broader business ecosystem.

Mr. Oktanto Dedi Winarko, as CEO, explained that a project's success is determined by how much the solution developed creates strategic impact for the client. He mentioned that in many cases, success is not just about systems functioning properly, but about generating changes in how organizations make

decisions, improving efficiency, or uncovering new opportunities. "If it's just a working system, that's not enough. We want our projects to deliver real benefits—both technologically and in business," he emphasized.

Mr. Deni Yulian, CTO, added that success also depends on maintaining technical quality throughout the project lifecycle. He emphasized the importance of collaboration between developers, field teams, and users so that the solution is not only algorithmically accurate but also user-friendly and adoptable. He noted that technical success is only meaningful if the technology can be used sustainably, without relying entirely on the vendor or original development team.

Ms. Sri Wulandari brought in an internal organizational perspective. According to her, project success also depends on the readiness of human resources and how internal teams adapt to changes brought by the project. She believes Big Data and AI projects are not just about technology—they are transformations of work culture. Therefore, she measures success in non-technical terms too, like team learning capacity, cross-functional collaboration, and responsiveness during project execution.

From a market angle, Mr. Budi Susanto noted that one indicator of success is how satisfied clients are and whether they are willing to continue working with the company. He pointed out that success does not always have to wait until a project is finished; in some cases, clients already feel the benefits early in the implementation. "If clients are talking about us to their colleagues and recommending our solutions, that's a sign of success," he said. He also emphasized that time, cost, and quality are still important—but client satisfaction and loyalty are the true reflections of project success.

The informants agreed that Big Data and AI project success is multidimensional—covering technical achievements, user acceptance, sustainability, and impact on organizational performance. They also stressed that such success is only possible with synergy between technology, people, business processes, and commitment to the company's strategic values.

Thematic Cross-Informant Analysis and Reflection on Findings

From in-depth interviews with four key informants—representing strategic to functional leadership levels at PT Dua Empat Tujuh—several central themes emerged that reflect alignment in perspectives while also providing a deeper understanding of the success behind the company's Big Data and Artificial Intelligence (AI) projects.

First, nearly all informants emphasized that project success is not solely measured by technical indicators such as timeliness, cost, and quality, but rather by the extent of strategic and transformational benefits experienced by clients. This perspective broadens the understanding of success as holistic, touching various dimensions from technological achievements to organizational behavior change among users.

Second, under the theme of strategic collaboration, there is agreement that a successful partnership is not just about business contracts but also about value alignment, knowledge transfer, and openness in co-developing solutions. Informants noted that successful collaboration directly contributes to innovation acceleration and effective implementation—provided it is managed with good and mutually beneficial governance.

Third, in the theme of product research, there is a strong awareness that innovation must be rooted in real market needs rather than just technological initiatives. This was emphasized by both technical and business stakeholders, who acknowledged that market sensitivity and regulatory understanding form a critical foundation to ensure products are relevant, competitive, and locally contextualized.

Fourth, human resource capability is central in every project undertaken. Findings from the interviews highlight that success

cannot be separated from a competent, adaptive team with a strong learning spirit. The company's investment in training, certification, and cross-functional team development shows a serious commitment to making human capital a continuously developed strategic asset.

Fifth, in terms of customer relationship management, the company positions its relationship with clients as a long-term partnership. Trust, data security, and after-sales service commitment are continuously reinforced. Beyond technical approaches, empathetic response and open communication are also considered vital to maintaining customer loyalty.

Finally, government regulation has become an increasingly significant determining factor. Although technical and bureaucratic challenges exist, informants noted that compliance with regulations such as the Personal Data Protection Law (UU PDP) and Domestic Component Level (TKDN) requirements presents opportunities to assert advantages as a local product and company. Regulation is understood not as a hindrance, but as a growth framework that encourages innovation and professionalism.

Overall, these findings show narrative alignment across informants, despite differing functional backgrounds. This indicates that PT Dua Empat Tujuh has cultivated collective awareness regarding the synergy of technology, people, market, and policy as essential to the success of Big Data and AI-based projects.

This reflection strengthens the earlier quantitative findings while also broadening the researcher's understanding that success in implementing high-end technologies such as AI is not just about hardware and software, but about an organization's capacity to learn, collaborate, and respond to change with agility and strategic thinking.

4.1.7. Triangulation of Quantitative and Qualitative Findings

Triangulation in this study is used to integrate the results of both quantitative and qualitative analyses as part of a mixed methods sequential explanatory approach (Creswell & Plano Clark, 2018). The aim is to test the consistency between findings from different methods, enrich the understanding of the studied phenomena, and enhance the validity of the research conclusions.

The triangulation process was carried out by comparing the results of hypothesis testing based on questionnaire data with findings from in-depth interviews with four key informants from both strategic and functional positions at PT Dua Empat Tujuh. The variables analyzed include Strategic Collaboration, Product Research, Human Resource Capability, Customer Relationship Management, Government Regulation as a moderating variable, and Project Success as the dependent variable. The table below summarizes the triangulation results for each variable:

Table 4.18

Summary of Triangulated Findings per Variable

Variable	Quantitative Finding	Qualitative Finding	Consistency	Brief Interpretation
X1 - Strategic Collaboration	Significantly positive effect on business performance	Emphasized by CEO & CTO as foundation for project growth	Consistent	Collaboration seen as innovation enabler; must be paired with knowledge transfer
X2 - Product Research	Not significant to business performance	Considered crucial by all informants, especially CTO and Account Director	Inconsistent	Potential time-lag effect; relevance high but impact not yet quantitatively visible
X3 - HR	Significantly	Emphasized by HR	Consistent	Project success

(Marketing) Capability	positive	and CEO as core of tech project		supported by adaptive, continuous-learning teams
X4 - Customer Relationship Management	Significantly positive	Viewed as strategic value and loyalty driver	Consistent	Success hinges on communication and post-project support
Z - Government Regulation (Moderation)	Significantly moderates X1 & X4	Seen to drive compliance and customer trust despite initial burden	Consistent	Regulation gives strategic direction, not a hindrance
Y1 - Project Success	Dependent variable influenced by X1–X4, proxied by efficiency, quality, impact	Defined as strategic transformation, not just technical output	Consistent	Success must result in tangible organizational and client transformation

This table illustrates the comparison between quantitative and qualitative findings for each research variable. The main purpose is to assess consistency and deepen the understanding from both approaches, emphasizing that the results are not solely derived from numbers but also from real-life experiences, narratives, and context.

For the **Strategic Collaboration** variable (X1), both approaches show a positive and significant relationship to project success. This suggests that the success of Big Data & AI implementation projects is greatly influenced by the company's ability to form value-based, productive partnerships. This is supported by informants who stressed the importance of synergy, knowledge transfer, and sustainable strategic relations.

Conversely, in the **Product Research** variable (X2), a discrepancy was found. Quantitatively, product research did not show a significant influence on business performance. However, from a qualitative standpoint, all informants—especially the CTO and Account Director—highlighted the importance of research as the foundation of innovation. This inconsistency may stem from the long-term nature of R&D impact, which is not yet reflected in the quantitative indicators used.

For the **HR Capability** (X3) and **Customer Relationship Management** (X4) variables, both approaches reinforce one another. Quantitative results show significant effects on project success, which are echoed in the qualitative interviews. Informants noted that technology success heavily depends on team readiness and strong client relationships, especially during implementation and after-sales phases.

Meanwhile, the **Government Regulation** variable (Z), serving as a moderating factor, also shows consistent findings across methods. Quantitative data reveal its significant moderation effect—particularly in strengthening strategic collaboration and customer management. Qualitative narratives confirm that regulations such as PDP Law and TKDN not only present compliance challenges but also offer strategic direction and trust-building opportunities.

Lastly, the **Project Success** variable (Y1) demonstrates alignment. Quantitatively, it is defined through time, cost, quality, and impact dimensions. Qualitatively, success is framed as strategic transformation felt by both clients and

the organization, beyond technical output. This suggests that project success is broadly understood and long-term value-oriented.

Overall, this table reinforces that triangulation is not merely a verification tool but also a **sense-making mechanism** allowing researchers to understand organizational dynamics more holistically and reflectively. Consistent findings strengthen model validity, while inconsistent ones enrich the analysis by offering new insights not captured in quantitative data alone.

Reflection on Consistencies and Inconsistencies in Findings

From the triangulation results, most variables show thematic consistency between the quantitative and qualitative approaches. Strategic Collaboration, HR Capability, Customer Relationship Management, Government Regulation, and Project Success all reveal alignment in both statistical results and informant narratives. This suggests a shared understanding among stakeholders regarding key success factors in Big Data & AI projects.

The only inconsistency lies in the Product Research variable, which is statistically non-significant but deemed highly important by all informants. This mismatch can be explained by a **time-lag effect** in innovation processes. According to Hair et al. (2017), the impact of R&D efforts often materializes over a longer period compared to other operational variables. It's also possible that the quantitative indicators used have not fully captured the strategic essence of ongoing research efforts.

The Added Value of Triangulation

The triangulation process in this study proves that combining quantitative and qualitative approaches provides a more comprehensive and nuanced understanding. The quantitative approach offers structure and generalizability, while the qualitative approach reveals contextual depth, motivation, and logic behind the numbers.

These findings support Creswell & Plano Clark's (2018) view that the **explanatory sequential design** is highly relevant for topics requiring holistic insights into organizational dynamics and technological strategy. By examining findings from both perspectives, researchers not only validate results but also uncover previously hidden insights.

In conclusion, this triangulation strengthens the evidence that the success of Big Data & AI projects at PT Dua Empat Tujuh is shaped by the complex interaction between strategic collaboration, human resource readiness, customer intimacy, product innovation, and regulatory compliance. This comprehensive understanding forms a solid foundation for developing sustainable data- and AI-driven business strategies.

4.2. Discussion

4.2.1. The Influence of Strategic Collaboration on Project Success

The research findings indicate that strategic collaboration significantly influences the success of Big Data and AI projects at PT Dua Empat Tujuh. This is supported by quantitative analysis showing a positive relationship between the strategic collaboration variable (X1) and project success (Y1), further reinforced by qualitative insights from interviews with company leaders and managers.

In the quantitative approach, strategic collaboration was measured through indicators such as goal alignment, resource sharing, and mutual trust. All these indicators contributed to project success in terms of goal achievement, time efficiency, and end-user satisfaction. This aligns with Dyer & Singh's (1998) assertion that **strategic interorganizational collaboration** can generate competitive advantage through information sharing, joint innovation, and resource synergy.

Qualitative interview results also support this finding. The CEO of PT Dua Empat Tujuh, Oktanto Dedi Winarko, explained that collaboration with partners—including tech

vendors, government agencies, and local partners—is not merely technical but reflects long-term commitment and mutually reinforcing values. He stressed that the success of large-scale projects like AI platform implementation cannot be achieved without strong coordination and synergy among all stakeholders.

From a technical standpoint, CTO Deni Yulian highlighted the importance of knowledge transfer in every form of collaboration. In his view, a good tech project is not only about the output but also about the process of shared learning. This supports Inkpen's (2005) argument that **value-creating collaboration** is one that internalizes learning and builds internal capabilities.

These findings are also echoed in previous studies, such as Nurhayati & Sofyan (2021), which found that Indonesian tech companies engaging in strategic partnerships with research institutions and global solution providers were more successful in accelerating their digital projects, particularly in government and public service sectors.

Contextually, PT Dua Empat Tujuh actively runs large-scale projects involving multiple parties, such as the development of a national data platform, AI system integration in public services, and collaboration with cloud and infrastructure providers. According to the interviews, the company does not merely act as a vendor but plays the role of a digital transformation partner. Thus, strategic collaboration becomes a crucial foundation for project continuity and trust-building with partners and clients.

This reflection highlights that project success is not only determined by internal strengths but also by the company's ability to forge and manage strategic external relationships. Healthy and mutually reinforcing collaboration can serve as a lever for success, accelerate innovation, and foster collective commitment to achieving shared goals.

4.2.2. The Influence of Product Research on Project Success

Based on the quantitative analysis results, the product research variable (X2) does not show a significant influence on the success of the Big Data and Artificial Intelligence project at PT Dua Empat Tujuh. This result is an interesting finding, as theoretically and conceptually, product research is often considered one of the key pillars in technological innovation and project success.

In the structural model testing, the t-statistic and p-value indicated that the relationship between product research and project success is not significant. This suggests that statistically, the questionnaire respondents did not view product research as a major factor determining the achievement of project success. This finding contradicts the framework proposed by Cooper (2019), which states that structured and focused product research can increase the likelihood of successful product launches and innovative projects.

However, in-depth interviews with informants revealed the opposite. CTO Deni Yulian explicitly stated that research and development are an integral part of the solution design process at PT Dua Empat Tujuh. Research is conducted not only in the form of technology exploration but also in market needs analysis, feature feasibility studies, and alignment with the latest regulations. He noted that internal research has been the foundation of many company products, including the AI platform and large-scale data management systems.

Account Director Budi Susanto also mentioned that the success of approaching clients, especially in government projects, is greatly influenced by a deep understanding of user needs, which is generally obtained through ongoing internal research. In practice, PT Dua Empat Tujuh not only offers solutions but also designs research-based approaches, including field research, industry case studies, and analysis of national regulations such as TKDN and the Personal Data Protection Law (UU PDP).

The discrepancy between quantitative and qualitative results can be explained in two ways. First, it is possible that respondents' perception of "product research" is limited to formal laboratory or R&D activities, while the company's research practices are more integrated and adaptive to market dynamics. Second, as suggested by Hair et al. (2017), research outcomes in technology projects are often lagging—where the impact is felt in the medium to long term—so their perceived contribution is not immediately reflected in questionnaire responses.

Another study by Day (2007) also highlights that product research which is poorly communicated or documented internally is at risk of not being widely recognized, even if it has strategic contributions. This may explain why respondents perceive product research as having low importance, even though in practice it plays a crucial role in product design and alignment.

Contextually, PT Dua Empat Tujuh has developed many competitive local technology-based solutions, which would not be possible without serious research processes. Therefore, although the quantitative findings are not significant, the qualitative approach shows that product research remains a backbone of innovation, even if its impact is not fully captured from the survey respondents' perspective.

4.2.3. The Influence of Human Resource Marketing Capability on Project Success

The research results show that human resource (HR) capability has a positive and significant influence on the success of the Big Data and Artificial Intelligence project at PT Dua Empat Tujuh. Statistically, variable X3 shows a strong path coefficient toward variable Y1, and the t-statistic and p-value meet the significance criteria. This finding strengthens the view that human factors remain a key element in the success of high-tech implementation.

Theoretically, this result aligns with the resource-based view (RBV) approach, which places internal capabilities—including human resources—as sources of competitive advantage (Barney, 1991). Competent, adaptive, and learning-capable HR provides a strong foundation for organizations to run complex and change-driven projects like Big Data and AI.

Interview results also support this quantitative finding. HR Manager Sri Wulandari emphasized that the company prioritizes HR development not only in technical aspects such as technology training and certification but also in soft skills such as communication, teamwork, and flexible thinking. She noted that large projects often face communication and cross-team collaboration challenges, making resilient and fast-learning HR a very crucial asset.

CEO Oktanto Dedi Winarko also stated that project success in the company cannot be separated from the work culture built within. A culture of learning, collective commitment, and loyalty to the company's vision drives alignment when facing project dynamics. This supports Schein's (2010) organizational culture theory, which states that technical capabilities will not be optimal without a culture that supports learning and innovation.

Meanwhile, CTO Deni Yulian provided a technical perspective, stating that the success of Big Data & AI systems cannot be achieved by a single expert alone. He emphasized the importance of cross-functional teamwork, where each member brings complementary expertise. This reflects Brown's (2009) concept of T-shaped people—employees with deep knowledge in one area and broad skills for cross-disciplinary collaboration.

Previous research also supports this finding. A study by Sugiharto & Mayangsari (2020) found that the success of technology projects in Indonesia's public sector heavily depends on the readiness of local HR, particularly in mastering new technologies and adapting to government regulations.

Contextually, PT Dua Empat Tujuh runs various strategic projects involving interactions with many external actors, including the

government, international vendors, and user institutions. In such an ecosystem, HR is not only required to master technology but also to understand policy dynamics, user needs, and system integration challenges. Therefore, project success is highly determined by the quality and agility of HR at all levels.

Thus, this finding confirms that investment in HR development is not a cost but a long-term strategy to build an organization ready to face complex and sustainable digital transformation challenges.

4.2.4. The Influence of Customer Relationship Management on Project Success

Customer relationship management (CRM) has a proven positive and significant influence on the success of the Big Data and Artificial Intelligence project at PT Dua Empat Tujuh. Quantitatively, variable X4 shows a direct contribution to Y1, with path coefficient, t-statistic, and p-value meeting the significance criteria. This finding reinforces the notion that in the context of data-based technology projects, the relationship between solution providers and end-users strongly determines overall implementation success.

Theoretically, this finding is consistent with modern CRM concepts as described by Payne & Frow (2005), where customer relationship management not only involves maintaining communication but also understanding customer needs proactively, personalizing services, and co-creating value. In Big Data projects—where success relies heavily on data quality, user context, and technology adaptation—strong customer relationships become strategic.

In-depth interviews support this finding. Account Director Budi Susanto stated that project success is closely linked to the quality of relationships built with customers, during pre-sales, implementation, and post-implementation stages. Clients don't just buy technology—they buy trust and assurance of sustainability. Therefore, the company commits to maintaining open communication, providing continuous technical support, and responding empathetically to customer needs.

The importance of empathy in customer relations was also noted by HR Manager Sri Wulandari, who emphasized that project teams must be equipped with good communication soft skills in addition to technical skills. In many cases, strong customer relationships have saved projects from potential conflict, delays, or misaligned expectations.

This finding is consistent with prior studies by Buttle & Maklan (2015), which showed that the success of IT system implementation is heavily influenced by the closeness between provider and user, especially in complex and dynamic project environments. In Indonesia, Raharjo and Winarto (2022) also emphasized that adaptive CRM approaches are critical in public and government sectors, where user expectations are often multidimensional and dynamic.

At PT Dua Empat Tujuh, CRM practices are not only embodied in platforms or formal systems but also in organizational policies such as deploying technical teams alongside clients, providing on-site training, and offering regulatory assistance. This model creates added value not only transactionally but also in building long-term loyalty and trust.

Thus, customer relationship management in Big Data and AI projects is not just a service strategy—it is an integral part of project success. Well-maintained relationships open effective communication channels, accelerate problem resolution, and ensure the solutions developed truly meet user needs.

5. Conclusion

5.1. Conclusion

This study aims to understand the key factors contributing to the success of Big Data and Artificial Intelligence (AI) projects at PT Dua Empat Tujuh. Through a combination of quantitative and qualitative approaches, the researcher sought not only to examine the statistical relationships between variables but

also to gain deeper insights into how these elements are perceived by practitioners in the field.

Based on the findings, several important conclusions can be drawn:

First, strategic collaboration has proven to contribute significantly to project success. In complex technology projects, cross-functional and inter-organizational cooperation is a key factor. From both technical and relational perspectives, strong collaboration facilitates adaptation, accelerates processes, and enhances a sense of ownership over the outcomes.

Second, human resource capabilities are also critical. A competent, fast-learning, and cross-disciplinary team is better prepared to face the challenges of dynamic projects. Interview findings clearly indicate that success is not solely about technical skills, but also about work mentality and a spirit of collaboration.

Third, managing customer relationships cannot be overlooked. Amid rapidly changing client needs and expectations, companies that maintain open communication, deeply understand customer needs, and consistently provide support will find it easier to build trust and ensure project sustainability.

Fourth, although product research did not show a significant quantitative effect, interviews revealed that research activities remain a foundational element of innovation. This may be because the impact of research is not always immediate, or not all parts of the organization fully grasp its value.

Fifth, government regulations do not act as barriers; rather, they can strengthen strategic relationships and build trust—especially when projects involve public institutions. When regulations are addressed wisely, they can add value to the company.

Lastly, project success is interpreted broadly within the organization—not only in terms of technical completion but also by the impact on the internal team, customer satisfaction, and the company's long-term reputation.

5.2. Recommendations

Based on the above conclusions, the following recommendations can be considered by the management of PT Dua Empat Tujuh as well as by future researchers:

a. Practical Recommendations for PT Dua Empat Tujuh

- **Strengthen cross-functional and external partner collaboration patterns.** Effective collaboration requires more than just communication; it demands a clear work structure and shared commitment from the beginning of the project.
- **Focus on continuous human resource development.** Mastery of technology alone is not enough. Employees need to be equipped with adaptability, communication skills, and the ability to work in dynamic teams.
- **Ensure product research is well-documented and directly linked to market needs.** This ensures that innovation does not stop in the laboratory but results in practical, usable solutions.
- **Build an active and participative customer relationship management system.** Clients who feel heard and involved are more likely to remain loyal and open over the long term.
- **Use regulations as strategic guidelines, not just compliance checklists.** By anticipating policy directions early, the company can gain a competitive edge over rivals.

b. Recommendations for Future Research

- This research can be expanded with a long-term approach to better capture the impact of activities such as product research.
- Future researchers are also encouraged to broaden the scope of study to include other companies, enabling comparisons of success patterns in technology projects across sectors.

- It would be beneficial for subsequent studies to develop broader project success indicators, such as impact on organizational culture, levels of internal innovation, or public trust.

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