

Digital Transformation and Management Capability in National Defense Posture: The Moderating Role of Defense Industry Self-Reliance

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Abstract

Digital transformation has become central to defense modernization, yet evidence remains limited on how digital capabilities and management capacity interact with national defense-industry self-reliance to shape national defense posture. This study examines the direct effects of digital transformation, management capability, and defense-industry self-reliance, and tests whether self-reliance changes the effects of digital transformation and management capability on defense posture. The conceptual model integrates Dynamic Capability Theory, which explains organizational sensing, seizing, and transformation processes, with the Resource-Based View, which emphasizes strategic resource endowments. A cross-sectional survey produced 225 usable responses from personnel and officials associated with Indonesian defense institutions. The constructs were measured with 90 perception-based items and analyzed using partial least squares structural equation modeling with bootstrapping and predictive assessment. Digital transformation had the strongest positive direct effect on national defense posture, followed by management capability and defense-industry self-reliance. Defense-industry self-reliance significantly weakened the positive relationship between digital transformation and defense posture, contrary to the predicted direction, while it strengthened the relationship between management capability and defense posture. The model explained 75.4 percent of the variance in national defense posture and showed substantial out-of-sample predictive relevance. The negative moderation indicates that industrial localization can create short-term compatibility, resource-allocation, certification, and implementation frictions when domestic capabilities are not synchronized with digital modernization. The study contributes by showing that strategic resources do not automatically amplify dynamic capabilities; their value depends on alignment and implementation timing. Policy should therefore prioritize interoperable digital architectures, phased localization, technology-transfer milestones, and managerial capability development so that industrial self-reliance complements rather than constrains digital defense transformation.

Keywords: Digital Transformation, Management Capability, National Defense Posture, Defense Industry Self-Reliance Strategy, Defense Management

1. Introduction

Digital transformation has emerged as a primary catalyst for defense system modernization across various nations. The integration of artificial intelligence (AI), big data analytics, cloud computing, the Internet of Things (IoT), cyber systems, and Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) has profoundly transformed the paradigm of defense organization management. This transformation has been marked by significant advancements in decision making quality, system interoperability, and the effectiveness of military operations. These developments indicate that digital transformation is no longer viewed merely as the adoption of technology; it has become a strategic capability that supports organizational adaptation to an increasingly dynamic security environment [1], [2], [3], [4], [5].

The contemporary global security environment is marked by a series of significant developments, including escalating geopolitical rivalry, the rapid advancement of defense technology, and the emergence of multidomain threats that encompass a wide spectrum of challenges, such as cyberattacks, information warfare, autonomous weapon systems,

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and the competition for dominance in strategic technologies. According to a report by the Stockholm International Peace Research Institute (SIPRI), there has been an ongoing increase in global military spending. This rise can be attributed to changes in the strategic environment and the need for defense modernization [6]. These conditions are prompting every country to fortify its defense capabilities through technological development, organizational capacity building, and institutional resilience to ensure sustained operational readiness [6], [7], [8], [9].

As an archipelagic nation, Indonesia faces challenges that are analogous to those experienced by other such nations due to the vast expanse of its territory and its strategic position in the Indo Pacific region. These geographical characteristics necessitate the development of a defense posture capable of ensuring national readiness against various forms of threats. According to the national defense policy, the development of defense capabilities must be supported by three key elements: technological modernization, the strengthening of organizational capacity, and the enhancement of defense industry self reliance. These elements are integral to the sustainable development of national defense [10], [11], [12], [13], [14], [15]. This development underscores the notion that the success of defense modernization is contingent not solely on the procurement of major weapons systems, but also on the implementation of digital transformation, management capabilities, and the fortification of the national defense industry.

Research on digital transformation, management capabilities, and strategies for defense industry self reliance has grown exponentially in recent years. Digital transformation has been demonstrated to enhance organizational effectiveness through technology integration and data driven decision making. Furthermore, management capabilities contribute to improved organizational coordination and the optimization of resource utilization. According to the findings of several other studies, strategies employed by the defense industry for self reliance play a crucial role in enhancing production capacity, logistical sustainability, and mastery of national defense technology [1], [2], [3], [4], [5], [13], [14], [15], [16], [17], [18], [19]. However, the majority of studies to date have examined these three variables in isolation, thereby failing to elucidate the interplay among digital transformation, management capabilities, and defense industry self reliance strategies in shaping a nation's defense posture.

Recent studies have established important but largely separate streams of evidence. Digital transformation research has primarily examined the adoption of advanced technologies, information quality, and data driven decision making, whereas management capability research has emphasized governance, coordination, resource allocation, and organizational readiness. Defense industry studies, in contrast, have concentrated on production capacity, technology transfer, supplier integration, and industrial competitiveness [1], [2], [3], [4], [5], [13], [14], [15], [16], [17], [18], [19], [20]. Consequently, existing evidence explains the direct value of technology, management, and industrial capacity but provides limited insight into whether domestic defense industrial capability changes the returns generated by digital and managerial capabilities.

This limitation creates a specific empirical and theoretical gap. Prior work generally treats defense industry self reliance as an antecedent of defense capability or as an industrial policy outcome [13], [14], [15], [20], [21], [22], [23]. It rarely tests self reliance as a boundary condition that can strengthen or constrain the translation of organizational capabilities into national defense posture. The distinction is important because the pursuit of domestic production and strategic technology autonomy may generate complementarities through local maintenance, supply security, and technology control, but it may also create transition costs, interoperability constraints, and resource allocation trade offs. Testing the moderating role of self reliance therefore moves beyond an incremental addition of another predictor and examines when digital transformation and management capability are more or less effective.

The theoretical contribution follows from integrating Dynamic Capability Theory and the Resource Based View at different analytical roles. Dynamic Capability Theory explains how defense organizations sense changes, seize technological and organizational opportunities, and transform routines, whereas the Resource Based View explains the value of strategically controlled resource bundles such as domestic industrial capacity, human capital, technology, and supply networks [18], [19], [24], [25], [26]. This study links the two perspectives by proposing that the value created by dynamic organizational capabilities depends partly on the configuration of strategic defense industry resources. Accordingly, the study tests three direct relationships and two interaction effects, with particular attention to whether defense industry self reliance amplifies or constrains the effects of digital transformation and management capability on national defense posture.

2. Literature Review

2.1. Dynamic Capability Theory

Dynamic Capability Theory (DCT) posits that organizations must possess the capacity to discern environmental shifts (sensing), capitalize on emergent opportunities (seizing), and transform resources (transforming) to maintain a competitive advantage in a dynamic environment [18], [19], [24]. This perspective underscores the notion that an organization's competitive advantage is not solely determined by its resources but also by its capacity to integrate, build, and reconfigure these resources in response to shifts in the strategic environment.

Within defense organizations, sensing is reflected in the ability to identify technological, cyber, geopolitical, and multidomain threats; seizing is reflected in the allocation of managerial attention, budgets, skills, and digital systems to emerging opportunities; and transforming is reflected in the reconfiguration of organizational routines, command processes, and technology architectures [18], [19], [24]. Digital transformation and management capability therefore represent dynamic processes through which defense institutions adapt their resource base. This interpretation differentiates dynamic capability from the possession of technology itself and provides the process-based explanation for the direct effects proposed in this study.

2.2. Resource-Based View

The Resource-Based View (RBV) posits that an organization's competitive advantage stems from its ability to manage resources that are valuable, rare, inimitable, and non-substitutable [25], [26]. This perspective underscores the notion that the success of an organization is contingent upon the effective utilization of strategic resources to establish sustainable competitive advantage.

In this study, the Resource-Based View is used to conceptualize defense-industry self-reliance as a strategic resource bundle rather than merely an industrial outcome. Domestic production capacity, innovative human capital, strategic technologies, maintenance capability, and supply-chain control can provide value when they are difficult to substitute and are effectively organized [13], [14], [15], [20], [25], [26]. These resources can improve readiness by reducing external dependence and supporting sustained access to critical defense capabilities. Their value, however, depends on how well they are integrated with organizational processes and technology architectures.

The two theories are therefore complementary rather than interchangeable. Dynamic Capability Theory explains how digital and managerial processes reconfigure resources, while the Resource-Based View explains the strategic resource base on which those processes operate. Defense-industry self-reliance can enhance dynamic capabilities when domestic technologies, skills, and supply networks are compatible with operational requirements, but it can constrain them during periods of localization, learning, certification, or system integration. This process-resource interaction provides the theoretical basis for examining defense-industry self-reliance as a moderator.

2.3. Digital Transformation and National Defense Posture

Digital transformation is defined as the process of integrating digital technology into an organization's activities to improve the effectiveness of information management, coordination, and decision-making. In the domain of defense, the implementation of artificial intelligence, big data analytics, C4ISR, and cyber systems has been demonstrated to augment an organization's capacity to discern threats, expedite information exchange, and enhance interoperability among units [1], [2], [3], [4], [5].

In accordance with Dynamic Capability Theory, digital transformation is indicative of an organization's capacity to respond to environmental changes by leveraging technology as a source of strategic advantage [18], [19], [24]. A multitude of studies have demonstrated that digital transformation has the capacity to enhance organizational effectiveness, expedite decision-making processes, and augment operational readiness [1], [4], [27], [28]. Consequently, the degree of digital transformation implemented by a defense organization directly correlates with the strength of the nation's defense posture.

H1 Digital transformation positively influences a nation's defense posture.

2.4. Management Capability and National Defense Posture

Management capability is defined as an organization's capacity to formulate plans, orchestrate activities, exercise oversight, and assess the utilization of resources in pursuit of strategic objectives. This capability has been demonstrated to enhance organizational effectiveness, decision-making quality, and program implementation efficiency [16], [17].

Dynamic Capability Theory posits that managerial competence constitutes a component of dynamic capabilities that facilitate organizational adaptation to shifts in the strategic environment [18], [19], [24]. A body of research has demonstrated that management capabilities contribute to enhanced organizational effectiveness, governance quality, and operational readiness in defense organizations [17], [29], [30]. Consequently, the enhancement of management capabilities is anticipated to fortify the nation's defense posture.

H2 Management capability positively influences a nation's defense posture.

2.5. Defense Industry Self-Reliance Strategy and National Defense Posture

The defense industry self-reliance strategy is an initiative aimed at bolstering national capabilities in the autonomous development, production, and maintenance of defense technology. This strategy endeavors to curtail reliance on foreign suppliers by fortifying industrial capacity, attaining mastery of technology, and cultivating the national supply chain [13], [14], [15].

The Resource-Based View posits that the defense industry constitutes a strategic resource with the potential to generate national advantage, contingent upon effective management [25], [26]. According to the extant literature, the enhancement of the defense industry has been demonstrated to engender an augmentation in production capacity, logistical sustainability, and the capacity to maintain defense equipment. Consequently, this has been shown to support improved national defense readiness [20], [21], [22]. Consequently, the strategy of self-reliance in the defense industry is anticipated to exert a favorable influence on the nation's defense posture.

H3 The defense industry self-reliance strategy positively influences a nation's defense posture.

2.6. Moderating Role of Defense Industry Self-Reliance Strategy

Defense-industry self-reliance can alter the effectiveness with which digital transformation and management capability are converted into national defense posture. From a complementarity perspective, domestic industrial capacity can provide secure technology access, local maintenance, supply continuity, and institutional learning, thereby supporting the implementation of digital systems and managerial decisions [13], [15], [20], [25], [26]. These mechanisms imply that strategic resources controlled within the national defense ecosystem can increase the operational value of organizational capabilities.

A competing transition mechanism is nevertheless plausible. Greater reliance on domestic technologies can temporarily create compatibility problems with established foreign platforms, certification requirements, parallel legacy systems, resource reallocation toward local capability building, and implementation lags while personnel and suppliers learn new architectures. These frictions may initially reduce the speed with which digital investments translate into operational readiness, even if self-reliance is advantageous in the longer term. The present study retains a positive directional prediction for the digital-transformation interaction because the expected long-run complementarity between sovereign industrial capacity and digital capability should dominate these transition costs; the direction is therefore empirically falsifiable rather than assumed after observing the results.

H4 The defense industry self-reliance strategy positively moderates the relationship between digital transformation and a nation's defense posture.

H5 The defense industry self-reliance strategy moderates the relationship between management capability and a nation's defense posture. The hypothesized relationships are summarized in [figure 1](#).

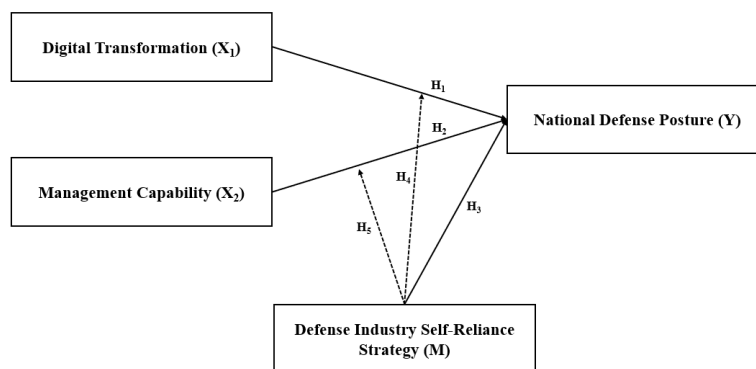


Figure 1. Research Framework

3. Methodology

This study employs a quantitative cross-sectional survey to examine the hypothesized relationships among digital transformation, management capability, defense-industry self-reliance, and national defense posture. The design is appropriate for estimating associations among latent constructs and testing interaction effects within the proposed conceptual model. Because observations were collected at one point in time, the results are interpreted as theory-consistent structural associations rather than longitudinal causal effects.

The analytical sample comprises 225 survey records from personnel and officials associated with the Ministry of Defense of the Republic of Indonesia, Indonesian Air Force Headquarters and operational units, the Air Force Academy, the Indonesian Defense University, and other defense-related institutions. Purposive sampling was used to select respondents with relevant experience, knowledge, or responsibilities in digital transformation, management, technology, operations, or defense development. Demographic information was available for 224 of the 225 analytical cases because one respondent record contained no demographic profile. The sampling strategy was designed to obtain informed expert assessments rather than statistical representation of all Indonesian defense stakeholders; therefore, the concentration of respondents in the Air Force ecosystem and the demographic imbalance are treated explicitly as limits to external validity.

The instrument contained 90 perception-based items measured on a ten-point response scale from 1 (lowest level of agreement/assessment) to 10 (highest level of agreement/assessment). Digital Transformation was measured by 18 items covering artificial intelligence, drones, cybersecurity, information warfare, globalization policy, and globalization challenges. Management Capability was measured by 18 items covering budget allocation, budget constraints, organizational environment, organizational culture, personnel skills, and personnel welfare. Defense Industry Self-Reliance Strategy was measured by 27 items covering national defense-industry strengthening, an innovative human-capital ecosystem, and strategic technology development. National Defense Posture was measured by 27 items covering military structure and personnel, force distribution and dislocation, operational readiness, supporting-force development, and major weapon-system modernization. The complete English-language item set is provided in Appendix A, while [table 1](#) summarizes the operationalization. The construct domains and indicator counts are summarized in [table 1](#).

Table 1. Operational Definition of Research Variables

Construct	Dimensions / item domains	Number of indicators	Main References
Digital Transformation (DT)	Artificial intelligence; drones; cybersecurity; information warfare; globalization policy; globalization challenges	18	[1]-[5]
Management Capability (MC)	Budget allocation; budget constraints; organizational environment; organizational culture; personnel skills; personnel welfare	18	[16]-[19] , [24]
Defense Industry Self-Reliance Strategy (DSRS)	National defense-industry strengthening; innovative human-capital ecosystem; strategic technology development	27	[13]-[15] , [20]

National Defense Posture (NDP)	Military structure/personnel; force distribution/dislocation; operational readiness; supporting-force development; weapon-system modernization	27	[10]-[15], [22]
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Data were analyzed using Partial Least Squares Structural Equation Modeling in SmartPLS 4 [31]. Seventeen missing item responses across the 90 indicators were handled using the software's mean-replacement setting. The measurement model was evaluated using outer loadings, Cronbach's Alpha, Composite Reliability, Average Variance Extracted, and the Heterotrait-Monotrait Ratio. The structural model was evaluated using the coefficient of determination, effect size, predictive relevance, and collinearity diagnostics. Hypotheses were tested with 5,000 bootstrap subsamples at a five-percent significance level. Predictive assessment additionally used blindfolding, out-of-sample prediction, and cross-validated predictive ability testing. The complete analytical workflow is summarized in figure 2.

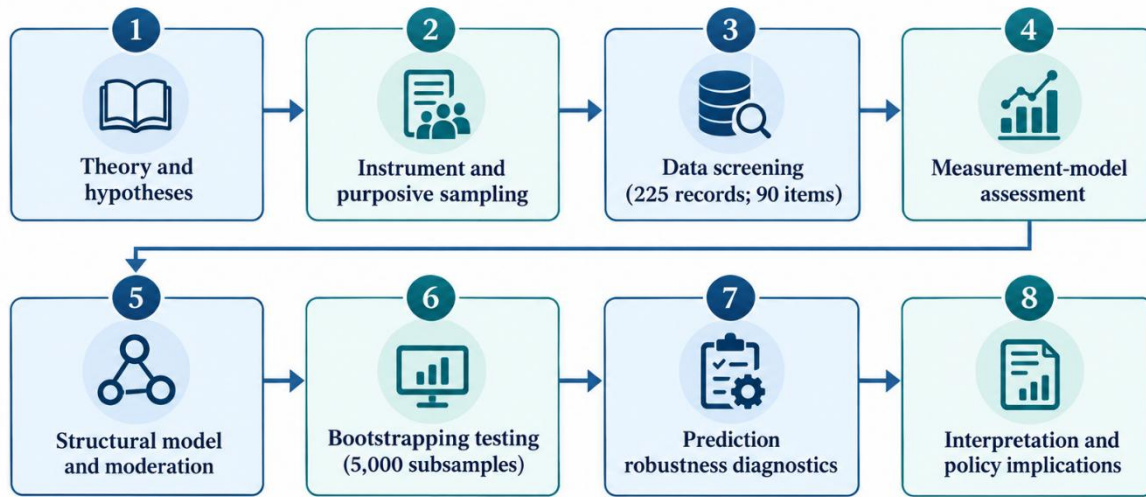


Figure 2. Research Analysis Flowchart

The measurement and structural relations were represented using the following equations, where x_j denotes an observed indicator, λ_j denotes an outer loading, and ζ denotes the structural disturbance term:

$$x_j = \lambda_j \xi + \varepsilon_j \quad (1)$$

$$NDP = \beta_0 + \beta_1 DT + \beta_2 MC + \beta_3 DSRS + \beta_4 (DT \times DSRS) + \beta_5 (MC \times DSRS) + \zeta \quad (2)$$

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}; \quad Q^2 = 1 - \frac{PRESS}{SSO} \quad (3)$$

The estimation sequence is stated explicitly in Algorithm 1 to make the analytical procedure reproducible.

Algorithm 1. PLS-SEM estimation and validation pseudocode

INPUT: survey matrix X (225 records $\times$ 90 indicators)

- 1 Screen responses and apply SmartPLS mean replacement to 17 missing item values.
- 2 Estimate the reflective measurement model.
- 3 Evaluate loadings, alpha, composite reliability, AVE, and HTMT.
- 4 Estimate the structural model with DT, MC, DSRS, DT $\times$ DSRS, and MC $\times$ DSRS.
- 5 Bootstrap 5,000 subsamples; evaluate paths, R^2 , f^2 , and VIF.
- 6 Evaluate Q^2 , $Q^2_{predict}$, CVPAT, and common-method diagnostics.
- 7 If interaction VIF > 10 , residual-center interaction scores and compare coefficient direction and magnitude.

OUTPUT: validated structural coefficients, predictive diagnostics, and hypothesis decisions.

Because all focal constructs were collected from the same respondents in one questionnaire, post-hoc common-method diagnostics were added. Harman's single-factor test was examined as a descriptive diagnostic, and full-collinearity variance inflation factors were calculated across the four latent-variable scores [32], [33]. These tests are treated as diagnostics rather than definitive proof that common-method bias is absent; the results are reported transparently in the measurement-model section.

The original interaction constructs were products of standardized latent-variable scores. Because the interaction variance inflation factors exceeded 10, simple mean-centering was first examined but did not alter the diagnostics because the latent scores were already centered. A residual-centering sensitivity analysis was therefore performed by orthogonalizing each interaction score with respect to the constituent main-effect scores before re-estimating the score-level structural regression. This robustness check follows the logic of orthogonalization approaches for latent-variable interactions [34] and is used to assess whether the signs and magnitudes of the moderation coefficients depend materially on severe product-term collinearity.

Formal multigroup analysis was not used as confirmatory evidence because the available demographic groups were highly unbalanced and underpowered for the weakest interaction. The post-hoc power output indicated that approximately 154 observations are required for the smallest interaction effect at five-percent significance and 80-percent power, whereas the largest practically meaningful rank, education, and tenure subgroups contained fewer observations than this requirement. Gender and service-branch comparisons were even more imbalanced. Consequently, subgroup stability is not claimed, and the sampling composition is addressed as a limitation and a priority for future multi-service replication.

4. Results and Discussion

4.1. Respondent Profile

The structural model was estimated using 225 survey records. Demographic information was available for 224 respondents and is summarized in table 2. The profile reflects the expert-oriented purposive sampling strategy and includes operational, educational, technical, and managerial personnel from multiple defense-related units, although the sample is concentrated in the Indonesian Air Force ecosystem.

Table 2. Respondent Profile (N = 224 demographic records)

Characteristic	Category	Freq.	Percentage (%)
Gender	Male	214	95.54
	Female	9	4.02
	Not reported	1	0.45
Highest Educational Attainment	Bachelor's Degree / Applied Bachelor's Degree	125	55.80
	Master's Degree	48	21.43
	Air Force Command and Staff College / Armed Forces Command and Staff College / National Resilience Institute	45	20.09
	Doctoral Degree	2	0.89
	Not reported	4	1.79
Military Rank	Captain	85	37.95
	Major	66	29.46
	Colonel	46	20.54
	Lieutenant Colonel	22	9.82
	First Air Marshal	2	0.89
	First Lieutenant	1	0.45
	Not reported	2	0.89
Years of Service	< 5 years	13	5.80
	5-10 years	44	19.64
	10-15 years	64	28.57
	15-20 years	46	20.54
	20-25 years	18	8.04
	25-30 years	31	13.84
	30-35 years	8	3.57

The demographic profile is strongly male dominated (95.54 percent of reported records), and the rank structure is concentrated among Captains, Majors, and Colonels. This composition is consistent with the institutional environment

from which the expert sample was drawn but limits demographic generalizability. At the same time, professional tenure is heterogeneous, ranging from less than five years to 30-35 years, and respondents were drawn from operational units, maintenance and technical organizations, education and training institutions, headquarters functions, and defense-related academic organizations. These characteristics support informed evaluation of the study constructs but do not establish representativeness across gender, the Army, Navy, joint commands, or commercial defense-industry leadership. The findings should therefore be generalized to those broader populations with caution.

Subgroup stability was considered but not interpreted through formal multigroup testing because the sample distribution does not provide adequately powered and balanced groups for the smallest interaction effect. This is especially relevant for gender and service-branch comparisons and remains important for rank, education, and tenure comparisons. The study consequently treats demographic and institutional heterogeneity as an external-validity issue rather than using underpowered subgroup estimates as confirmatory evidence.

4.2. Measurement Model

The measurement model was evaluated before interpretation of the structural paths. Indicator reliability, internal consistency, convergent validity, and discriminant validity were assessed using the original item-level measurement model. All retained outer loadings exceeded 0.70 and ranged approximately from 0.708 to 0.892, supporting indicator reliability.

The constructs intentionally contain multiple item domains because the concepts are broad and multidimensional. Digital Transformation and Management Capability each contain 18 items, while Defense Industry Self-Reliance Strategy and National Defense Posture each contain 27 items. The large number of coherent indicators contributes to high internal-consistency coefficients; therefore, high Cronbach's Alpha values were not interpreted alone as evidence of item redundancy. An item-level correlation inspection found no pairwise correlation above 0.90, with maximum within-construct correlations ranging from approximately 0.793 to 0.826. No items were removed solely to reduce reliability coefficients because doing so would narrow content coverage across the specified dimensions. The reliability and convergent-validity results are reported in [table 3](#).

Table 3. Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
Digital Transformation	0.972	0.974	0.677
Management Capability	0.979	0.981	0.738
Defense Industry Self-Reliance Strategy	0.984	0.984	0.701
National Defense Posture	0.986	0.987	0.739

Cronbach's Alpha and Composite Reliability values exceed conventional minimum thresholds, while Average Variance Extracted ranges from 0.677 to 0.739, comfortably above 0.50. The reliability coefficients are high, particularly for the longer 27-item constructs, but the more moderate Average Variance Extracted values, the observed loading range, the multidimensional item content, and the absence of extreme item-level correlations indicate that the scales are not composed of simple duplicate statements. The results therefore support convergent validity while acknowledging the need to avoid interpreting near-unity reliability as an unconditional advantage. Discriminant validity was subsequently appraised by means of the Heterotrait-Monotrait Ratio (HTMT). [Table 4](#) reports the discriminant-validity results.

Table 4. Discriminant Validity (HTMT)

Construct	DT	MC	DSRS	NDP
Digital Transformation	-			
Management Capability	0.834	-		
Defense Industry Self-Reliance Strategy	0.830	0.841	-	
National Defense Posture	0.833	0.810	0.806	-

All Heterotrait-Monotrait Ratio values are below 0.90, ranging from 0.806 to 0.841. The highest value is observed between Management Capability and Defense Industry Self-Reliance Strategy, but it remains within the recommended threshold. These results indicate that the four constructs are empirically distinguishable despite their conceptual interdependence within the defense system.

Potential common-method bias was assessed because all variables were self-reported in a single cross-sectional instrument. Harman's single-factor diagnostic indicated that the first unrotated factor accounted for 61.4 percent of item variance, which is above the commonly used 50-percent descriptive benchmark [32]. Full-collinearity variance inflation factors calculated from the latent-variable scores ranged from 3.866 to 4.273; these values are below the conventional collinearity threshold of 5 but exceed the more conservative 3.3 criterion proposed for common-method diagnostics [33]. Taken together, the diagnostics do not justify claiming that common-method variance is absent. The structural results are therefore interpreted cautiously and supported with effect-size, predictive, and collinearity-sensitivity evidence, while future work should incorporate temporal separation, multiple data sources, and objective defense-performance measures.

4.3. Structural Model

The structural model was evaluated using explanatory power, effect sizes, predictive relevance, and collinearity diagnostics. The revised results are based on the supplied SmartPLS output and the same 225 analytical cases used for hypothesis testing. The coefficient of determination is a statistical tool used to assess the extent to which independent variables can explain the variation in a dependent variable. Table 5 reports the coefficient-of-determination results.

Table 5. Coefficient of Determination (R^2)

Endogenous Construct	R^2	Adjusted R^2
National Defense Posture	0.754	0.749

An R^2 value of 0.754 indicates that the direct predictors and the two interaction terms jointly explain 75.4 percent of the variance in National Defense Posture. The adjusted value of 0.749 remains close to the unadjusted estimate, indicating that the model retains substantial explanatory power after accounting for the number of predictors. This aggregate explanatory strength, however, should be interpreted together with the effect sizes of individual paths. The contribution of each variable was then evaluated using the effect size (f^2). Table 6 reports the effect-size results.

Table 6. Effect Size (f^2)

Path Relationship	f^2	Category
Digital Transformation → National Defense Posture	0.176	Medium
Management Capability → National Defense Posture	0.060	Small
Defense Industry Self-Reliance Strategy → National Defense Posture	0.045	Small
Digital Transformation × Defense Industry Self-Reliance Strategy → National Defense Posture	0.046	Small
Management Capability × Defense Industry Self-Reliance Strategy → National Defense Posture	0.026	Small

Digital Transformation has the largest substantive contribution, with a medium effect size ($f^2 = 0.176$). Management Capability, Defense Industry Self-Reliance Strategy, and both interaction terms have small effect sizes ($f^2 = 0.026$ -0.060). Accordingly, statistical significance should not be interpreted as indicating equally large practical effects. The direct digital-transformation effect is the principal substantive driver, while the other predictors and moderators contribute incrementally within the broader defense system. The model's predictive capability was subsequently assessed by calculating the Q^2 value. Table 7 reports both in-sample and out-of-sample predictive relevance.

Table 7. Predictive Relevance and Out-of-Sample Prediction

Predictive Metric	Value
Blindfolding Q^2 for National Defense Posture	0.548
PLSpredict Q^2 predict for National Defense Posture	0.731

Blindfolding produced a Q^2 value of 0.548 for National Defense Posture, indicating substantial in-sample predictive relevance. PLSpredict produced a Q^2 predict value of 0.731, providing additional evidence of out-of-sample predictive ability. Cross-validated predictive ability testing further showed significantly lower prediction loss for the partial least squares model than both the indicator-average and linear-model benchmarks ($p < 0.001$ for both comparisons). These results support the model's predictive usefulness while remaining distinct from claims of demographic or cross-institutional generalizability. The multicollinearity test was conducted using the Variance Inflation Factor (VIF). Table 8 reports the original and residual-centered sensitivity VIF values.

Table 8. Variance Inflation Factor and Collinearity Sensitivity Analysis

Path Relationship	Original VIF	Residual-centered sensitivity VIF
Defense Industry Self-Reliance Strategy → National Defense Posture	4.039	3.864
Digital Transformation → National Defense Posture	3.870	3.656
Management Capability → National Defense Posture	4.077	3.943
Digital Transformation × Defense Industry Self-Reliance Strategy	11.027	5.736
Management Capability × Defense Industry Self-Reliance Strategy	11.669	5.736

The original main-effect variance inflation factors range from 3.870 to 4.077, while the two interaction terms have values of 11.027 and 11.669. These interaction values indicate severe product-term collinearity and should not be dismissed merely as a routine feature of moderation analysis. Because the latent-variable scores were already centered, additional mean-centering did not change these values. A residual-centering sensitivity analysis reduced the interaction variance inflation factors to 5.736 and the main-effect values to 3.656-3.943. The interaction coefficients retained the same direction and magnitude in the score-level sensitivity model: -0.251 for Digital Transformation × Defense Industry Self-Reliance Strategy and 0.200 for Management Capability × Defense Industry Self-Reliance Strategy. Thus, the principal moderation conclusions are not driven solely by the original values above 10, although residual moderate collinearity remains and the interaction estimates are interpreted cautiously [34].

4.4. Hypothesis Testing Results

Hypothesis testing used 5,000 bootstrap subsamples. Decisions were based on the direction of the hypothesized effect, the path coefficient, and the corresponding significance level. A statistically significant coefficient in the opposite direction to a directional hypothesis is reported as not supported rather than being relabeled as support after observing the data. Table 9 reports the bootstrapped path estimates and hypothesis decisions.

Table 9. Hypothesis Testing Results

Hypothesis	Path Relationship	β	P-value	Decision
H1	Digital Transformation → National Defense Posture	0.409	<0.001	Supported
H2	Management Capability → National Defense Posture	0.244	0.004	Supported
H3	Defense Industry Self-Reliance Strategy → National Defense Posture	0.212	0.002	Supported
H4	Digital Transformation × Defense Industry Self-Reliance Strategy → National Defense Posture	-0.251	0.005	Not supported (significant negative moderation)
H5	Management Capability × Defense Industry Self-Reliance Strategy → National Defense Posture	0.200	0.034	Supported (positive moderation)

H1, H2, and H3 are supported: Digital Transformation ($\beta = 0.409$, $p < 0.001$), Management Capability ($\beta = 0.244$, $p = 0.004$), and Defense Industry Self-Reliance Strategy ($\beta = 0.212$, $p = 0.002$) each have positive significant relationships with National Defense Posture. H4 is not supported in its hypothesized positive direction. The interaction between Digital Transformation and Defense Industry Self-Reliance Strategy is statistically significant but negative ($\beta = -0.251$, $p = 0.005$), indicating an unexpected weakening effect. H5 is supported because the interaction between Management Capability and Defense Industry Self-Reliance Strategy is positive and significant ($\beta = 0.200$, $p = 0.034$).

The moderation results therefore reveal asymmetry: self-reliance does not uniformly amplify organizational capabilities. Instead, it weakens the observed contribution of digital transformation while strengthening the contribution of management capability. This distinction is central to the theoretical and policy interpretation developed in the discussion. The estimated structural relationships and bootstrap results are visualized in figure 3.

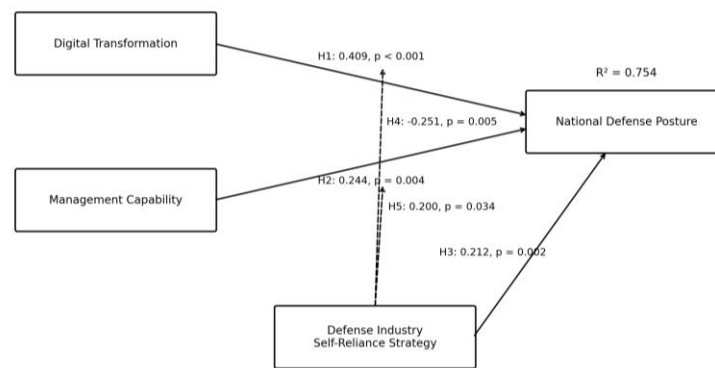


Figure 3. Structural Model and Bootstrapping Results

4.5. Discussion

Digital Transformation is the strongest predictor of National Defense Posture ($\beta = 0.409$) and the only predictor with a medium effect size ($f^2 = 0.176$). The result indicates that the integration of digital technologies, secure information systems, data-enabled decision processes, and adaptive responses to global threats can materially improve the ability of defense organizations to coordinate, respond, and sustain readiness. This finding is consistent with prior research on digital transformation and military information systems [1], [2], [3], [4], [5], [27], [28]. From the Dynamic Capability Theory perspective, the result reflects the value of sensing technological and security changes, seizing digital opportunities, and transforming organizational routines rather than merely acquiring technology [18], [19], [24].

Management Capability ($\beta = 0.244$, $f^2 = 0.060$) and Defense Industry Self-Reliance Strategy ($\beta = 0.212$, $f^2 = 0.045$) are also positive and significant, but their substantive effects are small. The findings therefore distinguish statistical significance from practical magnitude. Managerial planning, coordination, budget management, organizational culture, and personnel capability provide enabling conditions for defense readiness [16], [17], [29], [30], while self-reliance contributes through domestic industrial capacity, human-capital development, strategic technology, maintenance, and supply continuity [13], [14], [15], [20], [21], [22], [23]. Their smaller effect sizes suggest that these capabilities work as complementary components of a wider system rather than as stand-alone drivers comparable in magnitude to digital transformation.

The most theoretically informative result is the significant negative moderation of Defense Industry Self-Reliance Strategy on the relationship between Digital Transformation and National Defense Posture ($\beta = -0.251$, $p = 0.005$), which is opposite to H4. Several mechanisms can explain this finding. First, domestic technologies may not yet be fully interoperable with advanced foreign digital platforms, legacy command systems, or proprietary interfaces, creating technological friction. Second, localization programs can redirect budgets, managerial attention, and technical personnel from immediate digital deployment toward domestic production, certification, research, and supplier development. Third, new locally developed systems may require additional testing, accreditation, integration, and learning before they generate operational benefits. Fourth, simultaneous maintenance of imported legacy platforms and emerging domestic systems can create parallel architectures that slow data integration and standardization. These mechanisms imply an implementation lag: self-reliance may be strategically valuable in the long run while temporarily reducing the marginal operational return from digital transformation during the transition.

The negative interaction refines the integration of Dynamic Capability Theory and the Resource-Based View. Strategic resource ownership is not automatically complementary to dynamic capability. Resource-Based View logic explains why sovereign industry, technology, and skills can be valuable and difficult to substitute [25], [26], but Dynamic Capability Theory emphasizes that value is realized only when those resources can be reconfigured and integrated rapidly [18], [19], [24]. When domestic resource development creates compatibility or learning frictions, the resource base can temporarily constrain transforming processes. Conversely, the positive Management Capability $\times$ Self-Reliance interaction ($\beta = 0.200$, $f^2 = 0.026$) suggests that stronger domestic resources make managerial coordination, budgeting, organizational control, and personnel development more actionable. Self-reliance therefore operates as a conditional strategic resource whose effect depends on the organizational capability with which it interacts.

These results have specific policy implications. Defense institutions should avoid treating digital transformation and industrial localization as separate procurement agendas. Digital modernization should be built around interoperable and modular architectures, common data standards, cybersecurity requirements, and interface specifications that domestic suppliers can adopt from the outset. Localization should be phased according to technological readiness, with technology-transfer milestones linked to measurable operational-readiness outcomes rather than local-content targets alone. Joint integration laboratories involving users, defense industry, universities, and technology partners can reduce certification and compatibility delays. At the same time, management capability should be strengthened through program governance, digital skills, cross-unit coordination, and portfolio-based budgeting so that self-reliance resources are allocated to capabilities with the greatest operational value. The strong predictive results support the usefulness of this integrated model, but the small moderation effect sizes, common-source diagnostics, and sample composition require cautious interpretation beyond the studied context.

The sampling and measurement design also qualify the interpretation. The predominantly male and Air-Force-oriented expert sample provides relevant institutional knowledge but does not establish stability across gender, service branches, joint commands, or commercial defense-industry leaders. Formal multigroup claims were avoided because subgroup sizes were unbalanced and insufficient for the weakest interaction. In addition, all focal constructs were measured perceptually in the same questionnaire, and the common-method diagnostics indicate that method-related covariance cannot be fully excluded. Accordingly, the reported structural relationships should be viewed as robust within the present sample and predictive setting rather than as universally invariant parameters.

5. Conclusion

This study shows that Digital Transformation, Management Capability, and Defense Industry Self-Reliance Strategy are positively associated with National Defense Posture, with Digital Transformation providing the largest substantive contribution. Defense Industry Self-Reliance Strategy also functions as a boundary condition rather than a uniformly reinforcing factor. Its interaction with Digital Transformation is significant and negative, so the predicted positive moderation in H4 is not supported, whereas its interaction with Management Capability is positive and significant. The model explains 75.4 percent of the variance in National Defense Posture and demonstrates strong predictive relevance, but the interaction effects are small and should be interpreted as incremental rather than dominant.

The theoretical contribution lies in distinguishing dynamic organizational processes from strategic resource endowments. Digital Transformation and Management Capability represent sensing, seizing, and transforming processes, while Defense Industry Self-Reliance Strategy represents a resource bundle comprising national industrial capacity, innovative human capital, and strategic technology. The findings demonstrate that strategic resources can complement managerial capability while temporarily constraining digital capability when interoperability, localization, certification, and learning are not synchronized. Policy implementation should therefore prioritize interoperable digital architectures, phased localization based on technology readiness, measurable technology-transfer outcomes, integrated testing and certification, and sustained development of managerial and digital skills.

Several limitations remain. The study is cross-sectional and therefore cannot observe how the interaction between digital modernization and industrial self-reliance changes over time. The sample is purposive, predominantly male, and concentrated in the Indonesian Air Force ecosystem, limiting demographic and multi-service generalizability. Demographic profiles were available for 224 of the 225 analytical cases, and the unbalanced subgroup sizes did not support adequately powered confirmatory multigroup analysis for the weakest interaction. All focal constructs were measured through a single self-report instrument, and post-hoc diagnostics indicate that common-method variance cannot be fully ruled out. Finally, National Defense Posture is measured perceptually rather than with classified or administrative readiness metrics.

Future research should employ longitudinal and multi-source designs and expand sampling across the Army, Navy, joint commands, Ministry of Defense units, state-owned and private defense-industry leaders, and other national contexts. Larger balanced samples would allow confirmatory multigroup analysis by service, rank, tenure, education, and institutional role. Perceptual measures should also be triangulated, where access permits, with objective indicators such as operational-readiness rates, equipment availability, procurement-cycle efficiency, maintenance turnaround,

domestic-content realization, technology-transfer achievement, and interoperability performance. These extensions would test whether the negative digital-transformation interaction reflects a temporary transition effect and would provide a stronger basis for policy decisions on the sequencing of digital modernization and defense-industrial self-reliance.

6. Declarations

6.1. Author Contributions

Conceptualization: G.R., M.A.; Methodology: K.M.H.T., D.S.; Software: S.; Validation: M.A., D.S.; Formal Analysis: G.R.; Investigation: K.M.H.T., S.; Resources: M.A., D.S.; Data Curation: G.R.; Writing – Original Draft Preparation: G.R.; Writing – Review and Editing: K.M.H.T., D.S.; Visualization: S.; All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6.3. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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