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A model for transforming conventional industrial areas into eco-smart zones: The role of development planning, infrastructure, competence, and partnerships on success of the transformation process

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Abstract

This study aims to explore the impact of several independent variables on the commitment to area development and the success of the transformation process within urban settings. The background of the research is rooted in the increasing importance of strategic planning, technological advancements, and collaborative efforts in driving effective urban development initiatives. To achieve this, a quantitative research method was employed, utilizing hypothesis analysis based on data collected from relevant stakeholders involved in urban development projects. The findings reveal significant relationships between independent variables namely Planning for Transformation, Physical Infrastructure, Technology Infrastructure, Human Resource Competence, and Partnership Cooperation and commitment to area development. Notably, Technology Infrastructure emerged as the most influential factor. Furthermore, the study underscores that a strong commitment to area development is essential for the success of transformation processes. These results provide valuable insights into the critical factors that facilitate successful urban transformation, emphasizing the need for an integrated approach in planning and implementation.

Keywords: Collaborative partnerships, Development planning, Eco-smart zones, Industrial transformation, Infrastructure development.

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1. Introduction

The transformation of conventional industrial areas into eco-smart zones is vital for addressing global environmental challenges, as industries contribute around 24% of global CO2 emissions [1]. Developer commitment to green infrastructure, renewable energy, and sustainable technologies can lead to significant benefits, including up to 30% energy savings and 20-30% reductions in operating costs [2]. This aligns with global sustainability efforts, such as the UN Sustainable Development Goals and the net-zero emissions targets of over 130 countries by 2050 [3]. Furthermore, green financing reached $1.7 trillion in 2021 [4], emphasizing the growing global focus on eco-smart industrial transformations.

The Indonesian Ministry of Industry (Kemenperin) has emphasized the government's commitment to equitable industrial development by accelerating the establishment of industrial zones. This initiative includes the facilitation of the development of 27 industrial zones as part of the National Medium-Term Development Plan (RPJMN) for the period of 2020–2024 and 16 National Strategic Projects (PSN). According to the classification criteria for industrial zones, a minimum contiguous land area of 50 hectares is required, which is also a prerequisite for obtaining the Industrial Business License (IUKI) issued by the Ministry of Industry. One prominent industrial zone in Indonesia is the Karawang International Industrial City (KIIC), which spans approximately 1,500 hectares and has been operational since 1993. KIIC's mission is to provide a conducive working environment for tenants, enabling them to focus on their core activities. Strategically located in Karawang Regency, West Java, KIIC is situated on the island of Java and is easily accessible from the city center, which is just 5 kilometers away. The proximity to a population of approximately 2.4 million residents in Karawang ensures a substantial labor pool, thereby supporting the operational needs of various industries within the zone. This preliminary study highlights the government's strategic efforts to enhance industrial infrastructure and promote investment in designated areas, such as KIIC. The establishment of such industrial zones not only fosters economic growth but also plays a significant role in addressing the labor demands of the region, ultimately contributing to national development goals.

The success of the transformation process in regional development is influenced by several interrelated factors, including development planning, infrastructure, competence, partnerships, and the role of regional development commitment as an intervening variable. Each of these elements plays a crucial role in shaping the effectiveness and sustainability of transformation initiatives.

Effective development planning is foundational to successful transformation processes. It involves strategic foresight and the alignment of resources to meet regional needs. Infrastructure, both physical and digital, is critical in this context as it enables the execution of development plans. For instance, Brunetti et al. [5] emphasize the importance of a collaborative model of technological innovation and knowledge management that integrates various components of the regional innovative system, thereby enhancing the effectiveness of development planning [5]. Furthermore, Alojail et al. [6] highlight that successful digital transformation in educational institutions requires a robust framework that encompasses both planning and infrastructure, which can be adapted to various contexts [6].

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Competence within organizations is essential for navigating the complexities of transformation processes. The absorptive capacity theory, as discussed by Abdo and Edgar [7], suggests that organizations must effectively acquire, assimilate, and apply knowledge to foster innovation [7]. This capability is further supported by the infrastructure that facilitates knowledge management, which is crucial for sustaining competitive advantage in a rapidly changing environment. Mathieson et al. also point out that partnerships can enhance workforce pathways and competencies, thereby contributing to broader economic development [8].

Partnerships are a vital component of successful transformation processes. They facilitate resource sharing, knowledge exchange, and collaborative problem-solving among diverse stakeholders. The concept of regional partnerships, as explored by Chen et al. [9], indicates that cooperative organizations can significantly influence metropolitan economic development by addressing public goods that transcend local boundaries [9]. Additionally, the role of public-private partnerships (PPPs) is underscored by Ibyatov et al. [10], who argue that these collaborations are essential for regional development, particularly in addressing the limitations of state and regional authorities [10]. The collaborative approach to sustainability discussed by Dragomir and Foris [11] further illustrates how multi-stakeholder partnerships can optimize resource management and enhance development outcomes [11].

Regional development commitment acts as an intervening variable that can either facilitate or hinder the transformation process. This commitment is reflected in the willingness of stakeholders to engage in collaborative efforts and invest in shared goals. Dąbrowski notes that the partnership principle within the EU cohesion policy has catalyzed significant changes in governance patterns, promoting greater coordination among policy actors [12]. This highlights the importance of a committed approach to regional development, which can drive institutional change and enhance the effectiveness of partnerships.

The success of the transformation process in regional development is contingent upon a synergistic interplay of development planning, infrastructure, competence, and partnerships, with regional development commitment serving as a critical intervening variable. By fostering an environment conducive to collaboration and knowledge sharing, regions can better navigate the complexities of transformation and achieve sustainable development outcomes.

The urgency of this research arises from the critical need to address climate change, resource depletion, and environmental degradation, as industrial sectors account for approximately 24% of global CO_2 emissions [1]. With over 130 countries committing to carbon neutrality by 2050 [3] exploring effective transformation models is essential for developing sustainable industrial practices that align with international climate goals. Moreover, rapid urbanization and industrialization in developing economies necessitate proactive measures to create resilient industrial environments, where eco-smart zones can enhance competitiveness by optimizing resource use and reducing operational costs. The increasing trend in green financing, reaching $1.7 trillion in 2021 [4] further underscores the economic incentive to invest in sustainable practices. Therefore, this research is crucial for providing actionable frameworks that contribute to global sustainability efforts, support economic resilience, and promote environmental stewardship in response to escalating ecological challenges.

This study presents empirical novelty by developing a quantitative model that explores the interrelationships among development planning, infrastructure, competence, and partnerships in the context of transforming industrial areas into eco-smart zones. Unlike existing literature, which often examines these factors separately, this study employs Structural Equation Modeling-Partial Least Squares (SEM-PLS) to statistically analyze the influence of these variables on the success of the transformation process. This approach allows for the simultaneous assessment of complex relationships and the measurement of latent constructs, providing a robust framework for understanding how these factors collectively contribute to successful transformation. The research specifically focuses on conventional industrial zones, such as industrial parks and manufacturing hubs, to derive empirical insights and practical recommendations for policymakers and industry stakeholders. By utilizing a purely quantitative methodology, the study aims to fill gaps in the current literature while offering evidence-based strategies for effective transformation initiatives in sustainable urban development.

The primary aim of this study is to develop and empirically validate a model that elucidates the interconnected roles of development planning, infrastructure, competence, and partnerships in successfully transforming conventional industrial areas into eco-smart zones. The study seeks to identify how these factors influence the transformation process and contribute to the establishment of sustainable industrial practices. By employing a quantitative approach through Structural Equation Modeling-Partial Least Squares (SEM-PLS), the research aims to provide actionable insights and evidence-based recommendations for policymakers and industry stakeholders engaged in the transition toward more sustainable and environmentally friendly industrial practices.

2. Literature Review

2.1. Success of the Transformation Process

According to Li et al. [13], transformation is a process of gradual change, so that until it reaches the ultimate stage, changes are made by responding to the influence of external and internal elements that will direct changes from previously known forms through the process of doubling repeatedly or doubling. According to Kontić and Vidicki [14], the success of the transformation process includes several dimensions, including a digital-first mindset, practices, talent, and data access and collaboration tools.

The success of the transformation process is influenced by several critical factors, including effective development planning, robust infrastructure, competent leadership, strategic partnerships, and a strong commitment to regional development. Development planning guides transformation efforts, as highlighted by Kahramanoglu [15], who emphasizes the role of smart cities in enhancing socio-economic development through strategic initiatives [13]. Infrastructure is essential for executing these plans and ensuring connectivity, with Murahovscaia [14] noting its importance for optimizing business processes during transformations [14]. Competence, particularly in leadership, significantly impacts outcomes, as evidenced by Runa's [17] findings on transformational leadership enhancing employee readiness for change [15] and the necessity of both transformational and transactional leadership styles for promoting commitment [16]. Partnerships facilitate resource sharing and innovation, with Zhang [17] emphasizing their vital role in digital transformation [17] and Macleod et al. highlighting the importance of collaborative governance [18]. Lastly, regional development commitment reflects stakeholders' willingness to engage collaboratively and invest in shared goals, which is crucial for successful transformation initiatives [19]. Integrating these factors enhances organizations' capacity to navigate the complexities of transformation and achieve sustainable outcomes.

2.2. Development Planning

Transformation plan preparation is the process of formulating and planning the strategic steps needed to transform an organization or business from the current state to the desired state in the future [20]. Planning is a continuous process that includes several aspects, including spatial transformations, planning transitions, and role-reflexive planning [21].

The success of transformation processes in development planning hinges on effective strategic planning, which serves as a foundational framework for defining objectives and aligning resources with environmental characteristics. Hamdani and Koubaa [22] emphasize that strategic planning is essential for establishing goals and growth strategies in university transformations, highlighting the need for a structured approach to decision-making [22]. Similarly, Kuzu [23] points out that digital transformation in higher education requires strategic plans that prioritize learner experiences, indicating that personalization is critical for successful implementation [23]. Moreover, the integration of strategic spatial planning is crucial for sustainable urban development, as it facilitates collaboration among various stakeholders to achieve transformative outcomes [24]. This notion is echoed by Gustafsson et al. [27] who argue that strategic planning must be dynamic and adaptable to manage complexities and uncertainties in achieving sustainability [25]. Ultimately, the interplay of strategic planning and transformation processes is vital for enhancing performance and ensuring that development initiatives are effectively realized [26].

2.3. Physical Infrastructure

Physical and social infrastructure can be interpreted as part of the physical basic needs, the organization of structural systems necessary for the economic security of the public and private sectors, as well as services and facilities needed for the economy to function properly [27]. Physical infrastructure is an important foundation for the sustainability and productivity of society and economic development. Physical infrastructure dimensions include facilities and lifelines [28].

The success of transformation processes is significantly influenced by the development and optimization of infrastructure. New infrastructure construction plays a pivotal role in economic transition and industrial restructuring, serving as a foundation for technological advancements and digital economy growth [29]. This is particularly evident in sectors such as agriculture, where improved rural infrastructure has been shown to enhance productivity and economic development [30]. Moreover, the integration of digital infrastructure is crucial for facilitating digital transformation across various sectors, including small and medium-sized enterprises (SMEs) [31]. The presence of robust digital infrastructure not only supports operational efficiency but also enhances market reach and customer service capabilities [32]. Furthermore, strategic infrastructure planning, as highlighted in the National Infrastructure Plan of South Africa, aims to address socio-economic challenges and improve living standards through integrated projects [33]. In summary, the interplay between infrastructure development and transformation processes is essential for achieving sustainable economic growth and enhancing organizational performance across multiple sectors.

2.4. Technology Infrastructure

Information technology infrastructure consists of computer hardware and software, as well as data storage and networking technology, which is a portfolio of information technology resources shared among organizations [34]. Information Technology (IT) infrastructure is defined as a shared technology resource that provides a platform for detailed enterprise information system applications. According to Lewis and Byrd [37], the dimensions of technology infrastructure include chief information officer, planning, security, technology integration, advisory committees, enterprise model, information integration, and data administration.

Technology infrastructure is a fundamental component for the success of transformation processes across various sectors. A robust technological framework enables organizations to implement digital transformation effectively, enhancing operational efficiency and service delivery. For instance, Wintarto, et al. [35] emphasizes that technology facilitates the creation of user-friendly applications, which are crucial for banks to remain competitive in a digital landscape Wintarto, et al. [35]. This assertion is supported by Azieva et al. [39], who note that digital transformation requires not only new technologies but also a shift in managerial thinking and organizational strategies [36]. Moreover, Aldoseri et al. [40] highlight the importance of assessing an organization's technological infrastructure to identify gaps and develop a strategic roadmap for successful AI-driven transformations [37]. This is echoed by Kiprop [41], who asserts that a strong IT infrastructure is essential for supporting enterprise resource planning systems, which are vital for organizational scalability and efficiency [38]. Additionally, the integration of digital technologies in public sectors, as noted by Amin [42], streamlines processes and enhances service quality, demonstrating the transformative potential of technology infrastructure [39].

2.5. Competence

Human Resources Competence is the ability and characteristics that a person possesses in the form of knowledge, skills, and behavioral attitudes that are necessary in carrying out their duties in their work environment [40]. Human resource competence is the ability that a person has related to Functional Expertise, Knowledge of Business, and Managing Change [41].

Competence plays a critical role in the success of transformation processes across various sectors. Managerial competencies, in particular, have been shown to mediate the relationship between general competencies and business success in small and medium-sized enterprises (SMEs) [42]. This mediation highlights the importance of specific skills and knowledge that managers possess, which directly influence organizational performance and adaptability during transformation efforts. Moreover, effective communication and creativity among managers are essential for implementing transformational leadership styles, which are crucial for motivating employees and aligning them with organizational goals [43]. The development of digital competencies is also vital, as organizations require skilled personnel to navigate the complexities of digital transformation [44]. This need for competence extends to entrepreneurial skills, where the ability to innovate and adapt is linked to sustained competitive advantage and business success [45, 46].

2.6. Partnerships

Partnership is a mutually beneficial formal business cooperation between small entrepreneurs and medium or large entrepreneurs to achieve a common goal based on mutual agreement of principles [47]. Partnership is the process of interaction between two or more parties that is manifested in the form of cooperation. According to Jones and Barry [51], partnership cooperation includes trust and mistrust.

Partnerships are integral to the success of transformation processes, particularly in community-based and organizational contexts. Effective partnerships enhance collaboration and resource sharing, which are essential for achieving common goals. Drahota et al. [52] emphasize that well-structured meetings and ongoing communication strengthen community-academic partnerships, fostering trust and maintaining momentum [48]. Similarly, Brush et al. [53] highlight that shared leadership and community trust are critical for the sustainability of community-based participatory research partnerships [49]. Moreover, Rieckmann et al. [54] assert that the characteristics and processes of partnerships significantly influence their effectiveness, particularly in addressing complex issues such as climate change [50]. This aligns with findings by Duane and Domegan

[55], who note that securing infrastructure through partnerships is vital for implementing behavioral change programs [51]. Additionally, the role of practice partners in academic partnerships, as discussed by Landen and Hernandez [56], underscores the importance of collaboration in ensuring workforce readiness and program success [52].

2.7. Developer Commitment

Commitment is one of the work attitudes that reflects the feelings of each individual, both likes and dislikes towards the organization where he works [53]. According to Tayyab and Taqi [58], development commitment includes several dimensions, namely identification, involvement, and loyalty.

Developer commitment is a crucial factor in the success of transformation processes, particularly in the context of digital transformation and organizational change. Wahyono [54] emphasizes that commitment to change is vital for navigating the uncertainties associated with digital transformation, as it directly influences employee behavior and organizational success [54]. This commitment affects various performance metrics, including retention rates and organizational citizenship behavior, which are essential for successful implementation. Furthermore, Seo, et al. [55] highlight that both affective and normative commitment to change play significant roles in mediating the effects of leadership on employees' long-term responses to organizational change [55]. This suggests that fostering a strong sense of commitment among developers can enhance their engagement and adaptability during transformation initiatives. Additionally, Puni et al. [18] demonstrate that transformational leadership significantly impacts employee commitment, indicating that leaders who inspire and motivate their teams can enhance commitment levels, thereby facilitating smoother transitions [16]. Moreover, organizational commitment is identified as a core component of successful digital transformation efforts, as noted by Benkhider et al. [61], who argue that commitment underpins the effective implementation of digital technologies and employee training [56].

3. Method

3.1. Research Design

This study adopts a quantitative research methodology, utilizing a survey method to assess the roles of development planning, infrastructure, competence, and partnerships in the transformation of conventional industrial areas into eco-smart zones. The research is categorized as causal-comparative, aiming to elucidate the cause-and-effect relationships among the identified variables. By employing a structured survey instrument, the research seeks to gather data that quantitatively examines how each factor contributes to the success of the transformation process. Additionally, it aims to explore the interplay among these factors, identifying how development planning, infrastructure, competence, and partnerships collectively influence the effectiveness of the transformation initiative. This methodological approach facilitates a comprehensive investigation of the proposed relationships, providing empirical evidence regarding the dynamics of transforming industrial areas into sustainable eco-smart zones.

3.2. Research Subject

Population is a generalization area consisting of objects/subjects that have certain qualities and characteristics that are determined by the researcher to be studied and then drawn conclusions [57]. The population (N) in this study is employees of industrial estates located in the Karawang area, West Java. The sample is part of the number and characteristics possessed by the population [57].

3.3. Data Collection Technique

Data for this study will be gathered through a structured questionnaire distributed to key stakeholders, including urban planners, project managers, and policymakers involved in the development of conventional industrial areas transitioning to eco-smart zones. The questionnaire will focus on four key areas: development planning practices, infrastructure quality, organizational competence, and the nature of partnerships, with specific questions designed to capture detailed insights from the respondents. Alongside the primary data collected from the questionnaires, secondary data such as regional development plans and infrastructure investment reports will be incorporated to provide quantitative insights into the effectiveness of the transformation processes. Additionally, industry reports related to the development of eco-smart zones will be reviewed to contextualize the findings within the broader economic and regulatory framework. This comprehensive data collection approach will yield a thorough understanding of how development planning, infrastructure, competence, and partnerships collectively influence the success of the transformation process in conventional industrial areas.

3.4. Data Analysis Technique

Data analysis will be conducted using Structural Equation Modeling (SEM) techniques to explore the relationships among the independent variables (development planning, physical infrastructure, technology infrastructure, competence, and partnerships), the mediating variable (developer commitment), and the dependent variable (success of the transformation process). This approach employs path analysis to assess both direct and indirect effects within a unified model, which is essential for capturing the complex dynamics of how these factors collectively influence the transformation process. SmartPLS software will be utilized for its suitability in handling small sample sizes and non-normally distributed data, enabling the estimation of relationships among latent constructs while evaluating model fit, reliability, and validity. Ultimately, this analysis aims to clarify the role of development planning, infrastructure, competence, and partnerships in enhancing the success of the transformation process, thereby contributing to the broader understanding of effective strategies for transitioning conventional industrial areas into sustainable eco-smart zones.

4. Result

4.1. Outer Model Analysis

The following is a picture of the structural model for data processing using the Smart PLS application.

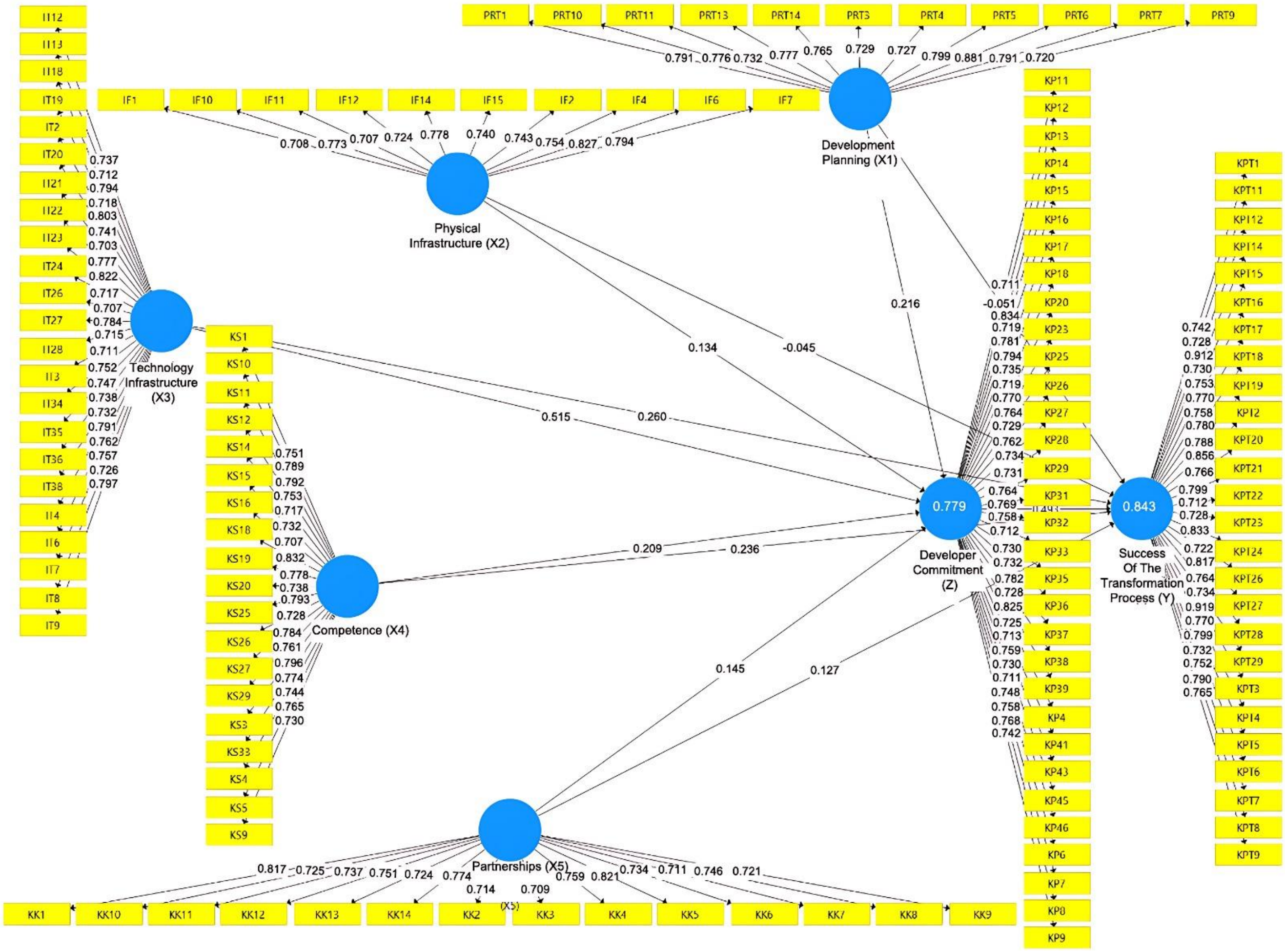

Figure 1.
Structural Model.

Validity testing is a crucial process that assesses whether an instrument or method accurately measures what it is intended to measure, thereby ensuring the accuracy and validity of the results [58]. In the Partial Least Squares (PLS) framework, two types of validity tests can be employed: Convergent Validity and Discriminant Validity. Convergent Validity evaluates the degree to which each indicator correlates with the latent variable it is intended to measure. This validity is considered satisfactory if the loading factor exceeds 0.7 and the Average Variance Extracted (AVE) is greater than 0.5 [59]. Conversely, Discriminant Validity is assessed through cross-loading values, which involve comparing indicators with other latent variables. For Discriminant Validity to be established, the cross-loading value must exceed 0.7, and the highest diagonal value must not be lower than the corresponding values for other indicators [32].

Table 1.
Composite Reliability and Convergent Validity Test Results.

	Items	Factor Loading	AVE	Composite Reliability	Cronbach's Alpha
(X1) Development Planning	X1.1	0.791	0.597	0.942	0.933
	X1.10	0.776			
	X1.11	0.732			
	X1.13	0.777			
	X1.14	0.765			
	X1.3	0.729			
	X1.4	0.727			
	X1.5	0.799			
	X1.6	0.881			
	X1.7	0.791			

	Items	Factor Loading	AVE	Composite Reliability	Cronbach's Alpha
	X1.9	0.720			
(X2) Physical Infrastructure	X2.1	0.708	0.571	0.930	0.916
	X2.10	0.773			
	X2.11	0.707			
	X2.12	0.724			
	X2.14	0.778			
	X2.15	0.740			
	X2.2	0.743			
	X2.4	0.754			
	X2.6	0.827			
	X2.7	0.794			
(X3) Technology Infrastructure	X3.12	0.737	0.563	0.967	0.965
	X3.13	0.712			
	X3.18	0.794			
	X3.19	0.718			
	X3.2	0.803			
	X3.20	0.741			
	X3.21	0.703			
	X3.22	0.777			
	X3.23	0.822			
	X3.24	0.717			
	X3.26	0.707			
	X3.27	0.784			
	X3.28	0.715			
	X3.3	0.711			
	X3.34	0.752			
	X3.35	0.747			
	X3.36	0.738			
	X3.38	0.732			
	X3.4	0.791			
	X3.6	0.762			
	X3.7	0.757			
	X3.8	0.726			
	X3.9	0.797			
(X4) Competence	X4.1	0.751	0.580	0.963	0.960
	X4.10	0.789			
	X4.11	0.792			
	X4.12	0.753			
	X4.14	0.717			
	X4.15	0.732			
	X4.16	0.707			
	X4.18	0.832			
	X4.19	0.778			
	X4.20	0.738			
	X4.25	0.793			
	X4.26	0.728			
	X4.27	0.784			
	X4.29	0.761			
	X4.3	0.796			
	X4.33	0.774			
	X4.4	0.744			
	X4.5	0.765			
	X4.9	0.730			

	Items	Factor Loading	AVE	Composite Reliability	Cronbach's Alpha
(X5) Partnerships	X5.1	0.817	0,558	0,946	0,939
	X5.10	0.725			
	X5.11	0.737			
	X5.12	0.751			
	X5.13	0.724			
	X5.14	0.774			
	X5.2	0.714			
	X5.3	0.709			
	X5.4	0.759			
	X5.5	0.821			
	X5.6	0.734			
	X5.7	0.711			
	X5.8	0.746			
	X5.9	0.721			
(Y) Success Of The Transformation Process	Y.1	0.742	0.608	0.976	0.974
	Y.11	0.728			
	Y.12	0.912			
	Y.14	0.730			
	Y.15	0.753			
	Y.16	0.770			
	Y.17	0.756			
	Y.18	0.780			
	Y.19	0.788			
	Y.2	0.856			
	Y.20	0.766			
	Y.21	0.799			
	Y.22	0.712			
	Y.23	0.728			
	Y.24	0.833			
	Y.26	0.722			
	Y.27	0.817			
	Y.28	0.764			
	Y.29	0.734			
	Y.3	0.919			
	Y.4	0.770			
	Y.5	0.799			
	Y.6	0.732			
	Y.7	0.752			
	Y.8	0.790			
	Y.9	0.765			
(Z) Developer Commitment	Z.11	0.711	0.562	0.976	0.975
	Z.12	0.724			
	Z.13	0.834			
	Z.14	0.719			
	Z.15	0.781			
	Z.16	0.794			
	Z.17	0.736			
	Z.18	0.719			
	Z.20	0.770			
	Z.23	0.764			
	Z.25	0.729			
	Z.26	0.762			
	Z.27	0.734			

	Items	Factor Loading	AVE	Composite Reliability	Cronbach's Alpha
	Z.28	0.731			
	Z.29	0.764			
	Z.31	0.769			
	Z.32	0.758			
	Z.33	0.712			
	Z.35	0.730			
	Z.36	0.732			
	Z.37	0.782			
	Z.38	0.728			
	Z.39	0.825			
	Z.4	0.725			
	Z.41	0.713			
	Z.43	0.759			
	Z.45	0.730			
	Z.46	0.711			
	Z.6	0.748			
	Z.7	0.758			
	Z.8	0.768			
	Z.9	0.742			

Table 1 presents the indicator values for each variable, with loading factors exceeding 0.7 and an Average Variance Extracted (AVE) greater than 0.5, indicating validity as per Muhtarom et al. [64]. Consequently, the validity test results for the variables displayed can be deemed valid. Additionally, the table indicates that each variable's indicator values have a Cronbach's Alpha above 0.6, as noted by Ghozali [60]. Therefore, the validity test results for the displayed variables can also be considered reliable, following the criteria established by Andreas [61].

Table 2.
R-Square Test Results.

Variable	R Square	R Square Adjusted
(Z) Developer Commitment	0.779	0.767
(Y) Success of the Transformation Process	0.843	0.833

4.2. Inner Model Analysis

The results of the R-Square Test reveal the extent to which the independent variables in the model account for the variability in the dependent variables under investigation. For the variable (Z) Developer Commitment, the R-Square value of 0.779 indicates that approximately 77.9% of the variance in developer commitment can be explained by the independent variables included in the model. The adjusted R-Square value of 0.767 further suggests that, after accounting for the number of predictors, the model still explains about 76.7% of the variability in developer commitment. In contrast, for the variable (Y) Success of the Transformation Process, the R-Square value of 0.843 signifies that 84.3% of the variance in the success of the transformation process is explained by the independent variables, demonstrating a robust model in elucidating the factors influencing this outcome. The adjusted R-Square value of 0.833 confirms that the model continues to account for approximately 83.3% of the variability in transformation success after adjustment. Overall, these R-Square values illustrate a strong predictive capability of the model in explaining variability in both developer commitment and the success of the transformation process, particularly highlighting the high level of explanatory power regarding the latter variable.

4.3. Hypothesis Testing

Mediation tests are employed to analyze the relationship between independent variables and dependent variables, incorporating mediating (intervening) variables [59]. This analysis categorizes mediation into three types: Non-Mediation, where the relationship between exogenous and endogenous variables is positive while the mediating variable is negative; Full Mediation, where the relationship between exogenous and endogenous variables is negative, but the mediating variable is positive; and Partial Mediation, where all relationships among the exogenous and endogenous variables, as well as the mediating variable, are positive. Furthermore, if the p-value for the Specific Indirect Effect exceeds 0.05, it is deemed negative; conversely, a p-value of 0.05 or less indicates a positive effect [59].

Table 3.
Hypothesis Analysis.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Preparation of Transformation Plan (X1) -> Regional Development Commitment (Z)	0.216	0.223	0.060	3.595	0.000
Physical Infrastructure (X2) -> Regional Development Commitment (Z)	0.134	0.137	0.055	2.442	0.015
Technology Infrastructure (X3) -> Regional Development Commitment (Z)	0.515	0.515	0.075	6.909	0.000
Competencies of Implementing Human Resources (X4) -> Regional Development Commitment (Z)	0.209	0.197	0.074	2.820	0.005
Partnership Cooperation (X5) -> Regional Development Commitment (Z)	0.145	0.142	0.062	2.316	0.021
Regional Development Commitment (Z) -> Success of the Transformation Process (Y)	0.493	0.476	0.101	4.879	0.000

The results of the hypothesis analysis reveal significant relationships between various independent variables and the commitment to area development (Z), as well as the success of the transformation process (Y). The variable of Planning for Transformation (X1) exhibits a positive relationship with a coefficient of 0.216, with a sample mean of 0.223 and a standard deviation of 0.060, yielding a T statistic of 3.595 and a p-value of 0.000, indicating a strong and statistically significant effect on commitment. Similarly, Physical Infrastructure (X2) shows a positive influence, with an original sample estimate of 0.134, a mean of 0.137, and a standard deviation of 0.055, resulting in a T statistic of 2.442 and a p-value of 0.015, suggesting a significant, albeit weaker, impact on commitment. Notably, Technology Infrastructure (X3) demonstrates the most robust relationship, with an original sample estimate of 0.515 and a T statistic of 6.909, alongside a p-value of 0.000, confirming its substantial influence on commitment to area development. Additionally, Human Resource Competence (X4) and Partnership Cooperation (X5) also positively impact commitment, with coefficients of 0.209 and 0.145, respectively, and p-values of 0.005 and 0.021, indicating their significant roles in enhancing commitment. Finally, the commitment to area development (Z) is found to significantly influence the success of the transformation process (Y), with an original sample estimate of 0.493, a T statistic of 4.879, and a p-value of 0.000, underscoring its critical importance in achieving successful transformation outcomes. Overall, these findings highlight the essential factors contributing to commitment and transformation success, particularly emphasizing the critical role of technology infrastructure.

The results of the hypothesis analysis indicate significant relationships between various independent variables and the commitment to area development (Z), as well as the success of the transformation process (Y). The variable of Planning for Transformation (X1) exhibits a positive relationship with a coefficient of 0.216, which is statistically significant (p-value = 0.000). This finding aligns with the literature that emphasizes the importance of strategic planning in facilitating transformative processes within urban development contexts. For instance, Albrechts, et al. [62] discuss how transformative planning can act as a catalyst for change, highlighting the need for a comprehensive vision that incorporates stakeholder engagement and adaptive strategies [62]. This is further supported by Potts, who argues that the integration of digital technologies into planning practices can enhance the effectiveness of transformation initiatives by fostering collaborative environments and improving decision-making processes [63].

Physical Infrastructure (X2) also shows a positive influence on commitment, with a coefficient of 0.134 and a p-value of 0.015. This suggests that investments in physical infrastructure are crucial for supporting area development initiatives. Research has demonstrated that robust infrastructure is foundational for sustainable urban growth and can significantly enhance the quality of life in urban areas [64]. The role of infrastructure in enabling effective planning and execution of development projects is underscored by the findings of Xue, who highlights the necessity of aligning urban planning with sustainability goals to facilitate transformative outcomes [64].

Technology Infrastructure (X3) demonstrates the most substantial relationship with a coefficient of 0.515 and a T statistic of 6.909, indicating its critical role in enhancing commitment to area development. The literature supports this assertion, as digital technologies are increasingly recognized as vital tools for improving planning efficiency and transparency. For example, Hersperger, et al. [65] illustrate how digitalization in land-use planning can lead to greater innovation and stakeholder engagement, thereby enhancing the overall effectiveness of planning processes [65]. Furthermore, the emergence of new paradigms in planning, as discussed by Potts, suggests that technology can transform traditional practices, making them more responsive to contemporary challenges [63].

Human Resource Competence (X4) and Partnership Cooperation (X5) also positively impact commitment, with coefficients of 0.209 and 0.145, respectively. These findings underscore the importance of human capital and collaborative networks in driving successful transformation efforts. Research by Nguyen et al. [71] highlights the significance of transformational leadership in fostering employee creativity and engagement, which are essential for navigating the complexities of change [66]. Additionally, the role of partnerships in enhancing the capacity for transformation is well-documented, with studies indicating that collaborative approaches can lead to more sustainable and effective outcomes in urban planning [67].

The commitment to area development (Z) significantly influences the success of the transformation process (Y), with an original sample estimate of 0.493 and a T statistic of 4.879. This finding emphasizes the interconnectedness of commitment and successful transformation outcomes. The literature suggests that a strong commitment to development initiatives is essential for achieving long-term sustainability and effectiveness in urban planning. For instance, Habeeb discusses the critical role of strategic planning and transformational leadership in driving organizational performance and sustainability in higher education contexts, which can be extrapolated to broader urban development scenarios [67].

In conclusion, the findings from the hypothesis analysis reveal that various independent variables, including Planning for Transformation, Physical Infrastructure, Technology Infrastructure, Human Resource Competence, and Partnership Cooperation, significantly contribute to commitment to area development. Furthermore, this commitment is crucial for the success of transformation processes. The literature consistently supports these findings, highlighting the importance of strategic planning, technological integration, and collaborative efforts in achieving transformative outcomes in urban development.

5. Conclusion

This study provides compelling evidence of the significant relationships between various independent variables namely Planning for Transformation, Physical Infrastructure, Technology Infrastructure, Human Resource Competence, and Partnership Cooperation and the commitment to area development (Z). The findings underscore the critical importance of these factors in fostering a strong commitment, which in turn is essential for the success of the transformation process (Y). Notably, Technology Infrastructure emerged as the most influential variable, indicating that technological advancements play a pivotal role in enhancing commitment and facilitating effective urban development initiatives. Additionally, the positive impacts of Human Resource Competence and Partnership Cooperation highlight the necessity of skilled human capital and collaborative networks in driving successful transformations. This research aligns with existing literature that emphasizes the integration of strategic planning and technology in urban development, reinforcing the idea that commitment to development initiatives is vital for achieving long-term sustainability and effectiveness. Ultimately, these insights contribute to a deeper understanding of the dynamics involved in area development and transformation processes, offering valuable implications for policymakers and practitioners in the field.

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