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Original Article

Exploring the Performance Domain Causal Relationship of Digital Government Transformation Project Management

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Abstract - *This research determined the specific challenges that are encountered in the Digital Government Transformation (DGT) within the Indonesian construction sector. This research builds upon prior investigations and some theories by examining the impact of project management variables on DGT performance and public value creation. The analysis was conducted using the structural equation model (SEM) with data collected from a survey comprising 140 responses from the project team. The results showed that project performance is predominantly affected by a combination of four factors within the performance domains, namely deliverable/output, measurement, development approach, and project life cycle. In addition, the structural model indicated a significant correlation between the performance of DGT implementation and the attained value. Therefore, ensuring the existence of these factors in DGT project management within the construction industry becomes the key duty of a DGT project manager. The study offered valuable information on improving the administration of DGT projects while also highlighting the results and potential future advancements of the novel framework.*

Keywords - *Digital government transformation, Performance domain, Project management, Value creation.*

1. Introduction

Governments in various countries have recognized the need for efficient, effective, transparent, and accountable public services, and many have pledged to expedite digital transformation to achieve significant innovation. In line with this commitment, the Indonesian government viewed digital transformation as an essential element to address the challenges of the 4.0 era. As part of their Digital Government Transformation (DGT) initiative, Indonesia focused on several key sectors, with particular emphasis on the construction industry, which played a vital role in the economy of the nation. The digital transformation journey of the Indonesian construction sector started in 2017 with the establishment of an Integrated Construction Services Information System (ICSIS). The main objective of ICSIS is to improve the governance of business services and foster collaboration among government agencies, ultimately enabling them to operate more effectively and efficiently. However, the current maturity level of ICSIS stands at 2.6 on a 5-point scale, representing the lowest threshold for good performance [1]. This indicated the presence of fragmented business processes, incompatible systems, and a lack of data accountability within the system.This research contributed to previous theoretical reviews by exploring how the project management variables affected the performance of the DGT project and its capacity to generate public value. It focused on essential modelling steps, including identifying variables, formulating hypotheses, and developing constructs and measurement indicators. Special attention was paid to the distinctions between various types of constructs, particularly using the performance domain from the Project Management Body of Knowledge (PMBOK) 7th edition. Additionally, this research investigated the DGT implementation factor derived from previous reviews and categorized it into eight performance domains.

Based on relevant literature, the following hypothesis was formulated. Firstly, it is hypothesized that the eight performance domains of PMBOK positively influence the performance of the DGT project. Previous research and theoretical frameworks consistently suggested that these domains were crucial in improving project performance [2]. The following hypothesis was proposed and tested based on relevant literature. Secondly, it proposes that DGT performance positively influences the creation of three categories of public value.

Prior research consistently reported that project performance significantly impacted the enhancement of government services [3–6], public administration [4] and social value [7, 8]. Therefore, based on existing literature, this hypothesis would be tested to assess the relationship between DGT performance and public value creation across these three categories. Previous research has extensively explored the multifaceted nature of DGT. For example, Liva et al. [9] investigated the intricacies, placing significant emphasis on non-technological facets such as organizational and social aspects. Lindgren et al. [10] further underscored the importance of multiple change processes to sustain DGT and amplify public value. Additionally, Tangi et al. [11] expanded this understanding by proposing key factors, including urgency and collaboration, that influence the trajectory of DGT. Therefore, there is a gap in understanding the specific issues within the construction sector during DGT. In the continuum of this research landscape, the present study takes a different approach, specifically focusing on DGT within the Indonesian construction sector. Unlike previous studies, our research concentrates on project management variables, encompassing deliverables, measurement, development approach, and project life cycle.

In addition, this present research focused on three main objectives. The first objective was to validate the project management model by investigating the relationship between variables and indicators of DGT. The second objective examined the relationship between project management variables and DGT performance. The third objective sought to investigate the impact of DGT performance on public value creation. To accomplish these objectives, a survey was conducted with the analysis based on responses from 140 participants responsible for DGT project construction and management.

2. Literature Overview

DGT is a contemporary and comprehensive concept within public administration that signifies the systematic and inclusive evolution of governmental processes through the strategic integration of digital technologies [12]. This transformative initiative extends beyond the conventional scope of e-government approaches, embodying a holistic perspective that not only incorporates technological advancements but also explores the cultural, organizational, and relational dimensions of public organizations. DGT distinguishes itself by recognizing the multifaceted and disruptive impact of digital technologies on individuals, organizations, and society at large. Anchored in the broader trajectory of 'digital transformation,' initially coined by business scholars, DGT highlights the intricate interplay between technological innovations and the complex socio-technical systems that define organizational structures. According to the perspective put forth by Venkatraman [13], the essence of transformation lies in its dual influence on both the technical and social elements of organizations. In this view, organizations are seen as intricate socio-technical systems comprising interconnected elements such as process, people, culture, structure, and information systems. These elements collectively form two macro-systems: the technical system, responsible for transforming input into output, and the social system, encompassing elements related to the organizational environment, culture, values, and authority structure. The significance of DGT lies in its acknowledgment that successful transformations necessitate concurrent changes across both technical and social systems, ensuring the full realization of benefits derived from strategic investments in digital technology [12].

Prior research has indicated that the implementation of DGT in various countries faced challenges due to the inability of government agencies to establish and manage such initiatives effectively. Furthermore, the implementation of digital transformation projects has generally been unsuccessful, and failure rates have remained relatively high [14]. The success rates of these projects have remained relatively low, with a significant number of developing countries experiencing absolute failure (35%), partial success or failure (50%), and only a small percentage achieving success (15%) [4, 15, 16]. One common issue identified in the failure of digital transformation projects is the tendency of numerous governments to create ambitious plans without a comprehensive understanding of the fundamental objectives, resulting in the failure to realize the potential benefits [17, 18].

Inadequate and conventional project management approaches were also identified as contributing factors to the failure of digital transformation efforts. The research conducted in Indonesia reported gaps in project management, with a heavy reliance on traditional approaches that prioritized implementation factors such as measurement, control, and rules. These traditional project management practices tend to be activity-centred and focus on cost savings and increased productivity, often neglecting crucial information technology considerations, thereby raising various issues in the process [19].

DGT implementation is a complex endeavour, primarily due to the dynamic nature of its life cycle, the involvement of multiple stakeholders, and communication gaps arising from diverse expertise [20]. Traditional rationality-based project management approaches are incapable of tackling these complexities effectively. In order to enhance the performance of DGT projects, several research conducted in various countries explored alternative management approaches that were integrated, flexible, and adaptable to change. These approaches emphasized a behaviour-focused, knowledge-centred, and systemic perspective. It advocated for the implementation of a transformation management system that took into account political, economic, human, social and technical factors to guide the life cycle of the project [18, 20, 21].

Table 1. Digital government project management

S. no	Project Management	References
1	Project integration management: (1) Pre-conditioning stage; (2) Project management stage; (3) Managing transition stage; and (4) Innovating stage continuously	[23]
2	Project management encourages the integrated, flexible, and dynamic management cycle to cope with change, behaviorally focused, knowledge-centered, and systemic.	[18]
3	A transformation management system that considers the whole project life cycle and combines hardware and software characteristics is designed to handle the challenges of government transformation initiatives.	[20, 21]
4	Comprehensive management of mutual assistance, with good planning of technical and non-technical factors.	[3], [24]
5	Project management is based on eight performance domains and focuses on achieving value.	[2]

Furthermore, these approaches emphasized aligning with the vision of commitment development, human resource management, and cultural change [22]. Recent developments in project management theory highlighted the importance of measuring the value gained beyond accomplishing project outputs [2]. This broader perspective included personal (integrity and honesty) and organizational values (transparency and responsiveness), as well as ethical considerations (impartiality and objectivity) [7]. Previous research also proposed various techniques for managing DGT projects, as shown in Table 1.

In the 7th edition of the PMBOK, modern systematic project management was developed by introducing 12 fundamental principles. These principles formed the foundation for all projects, including stewardship, team collaboration, stakeholder engagement, value focus, system thinking, effective leadership, tailoring, quality management, addressing complexity, managing risk, adaptability and resilience, and embracing change [2].

For successful project delivery, it is essential to internalize these fundamental principles within the project performance domain. This domain encompassed a set of activities that determined the effectiveness of project execution. It comprised eight project management performance domains, namely (1) stakeholder management, (2) team collaboration, (3) development approach and life cycle, (4) planning, (5) project execution, (6) deliverable and output management, (7) measurement of project progress, and (8) uncertainty or risk management. Project management is crucial in DGT, particularly as governments globally leverage Information and Communication Technology (ICT) to modernize their services and enhance citizen experiences [25].

The adoption of digital technologies in government organizations has become a strategic imperative to ensure efficient, transparent, and citizen-oriented governance. However, the implementation of large-scale digital government transformation projects introduces complexities, including budget overruns, delays, and challenges in meeting citizen expectations [26]. Traditional project management approaches often fall short in addressing these issues, emphasizing the need for agile project management methodologies. Agile, with its iterative, incremental, and highly flexible nature, proves instrumental in navigating the intricacies of DGT [27]. Its application is essential for better stakeholder engagement, quicker delivery of usable digital products or services, close monitoring of project progress, and, ultimately, building trust and confidence among citizens in government initiatives. In the context of DGT, effective project management becomes a linchpin in realizing the full potential of ICT to create a more responsive, citizen-centric, and digitally advanced public sector.

3. Research Design and Methodology

3.1. Variable Measurement

DGT performance (PI) serves as the dependent variable, representing the overall effectiveness of DGT initiatives in the Indonesian construction sector. The independent variables include team performance domain (TP), work performance domain (WP), delivery performance domain (DO), risk or uncertainty management performance domain (RM), measurement performance domain (MP), planning performance domain (PP), development and life cycle performance domain (DLC), and stakeholder performance domain (SP). These independent variables collectively influence DGT performance. Furthermore, public value (VI) is introduced as an additional dependent variable, wherein it depends on DGT performance (PI).

3.2. Survey Instrument

This research employed a quantitative approach and collected primary data through field questionnaires. The questionnaire was constructed based on findings from the literature review and consisted of pre-set variables. These were organized in the form of questions answered and assessed using a Likert scale. The questions were designed positively to minimize any bias towards certain answers. The measured variables focused on assessing the perceived level of DGT implementation performance perceived by respondents. In order to measure these variables, respondents were asked to rate indicators on a Likert scale ranging from 1 to 4. The scale represented different assessment levels, with 1, 2, 3, and 4 indicating very low, low, high, and very high-performance assessments, respectively.

3.3. Sample and Data Collection

This research focused on DGT projects within the Indonesian construction sector, which included 42 interoperable systems. However, data were collected by conducting a sector-wide survey towards the end of 2022. The survey used purposive sampling techniques to specifically target respondents identified as group members, leaders, and managers in charge of the DGT project.

The questionnaire was completed by 140 respondents, comprising 82 government officials, 36 Construction Services Certification Agencies (CSCA) and 22 project managers and members from Construction Professional Certification Agencies (CPCA). The total sample satisfied the Slovin formula minimum sample size requirement of 135. The characteristics of respondents were identified based on (1) age, (2) gender, (3) institutions and agencies, (4) level of education, and (5) work experience.

An application for full ethical approval was made to the Universitas Tarumanagara, and ethics consent was received on July 14 2022. The ethics approval number is 1764-DIR.PBL/UNTAR/VII/2023.

3.4. Validity and Reliability

Furthermore, to ensure the quality of the data, it was necessary to validate and establish the reliability of the questionnaire before distributing it to the respondents [28, 29]. The validity and reliability of the survey instrument were tested on a sample of thirty prospective implementation respondents. The validity test was conducted using the Pearson product-moment correlation approach at a significance level of 5%.

3.5. Data Analysis Method

The Variance Based-Structural Equation Model (VB-SEM) was used in this research, supported by the SMART-PLS 4.0 data processing program. This methodology facilitated examining theoretical relationships between constructs and assessing predictive validity for exogenous variables. The hypotheses were examined and compared to determine the extent to which a theory could accurately predict project success and public value creation. The primary advantage of SEM is its ability to measure complex model relationships while accounting for measurement errors inherent in indicators. The SEM consists of two main components, namely measurement and structural models [30, 31].

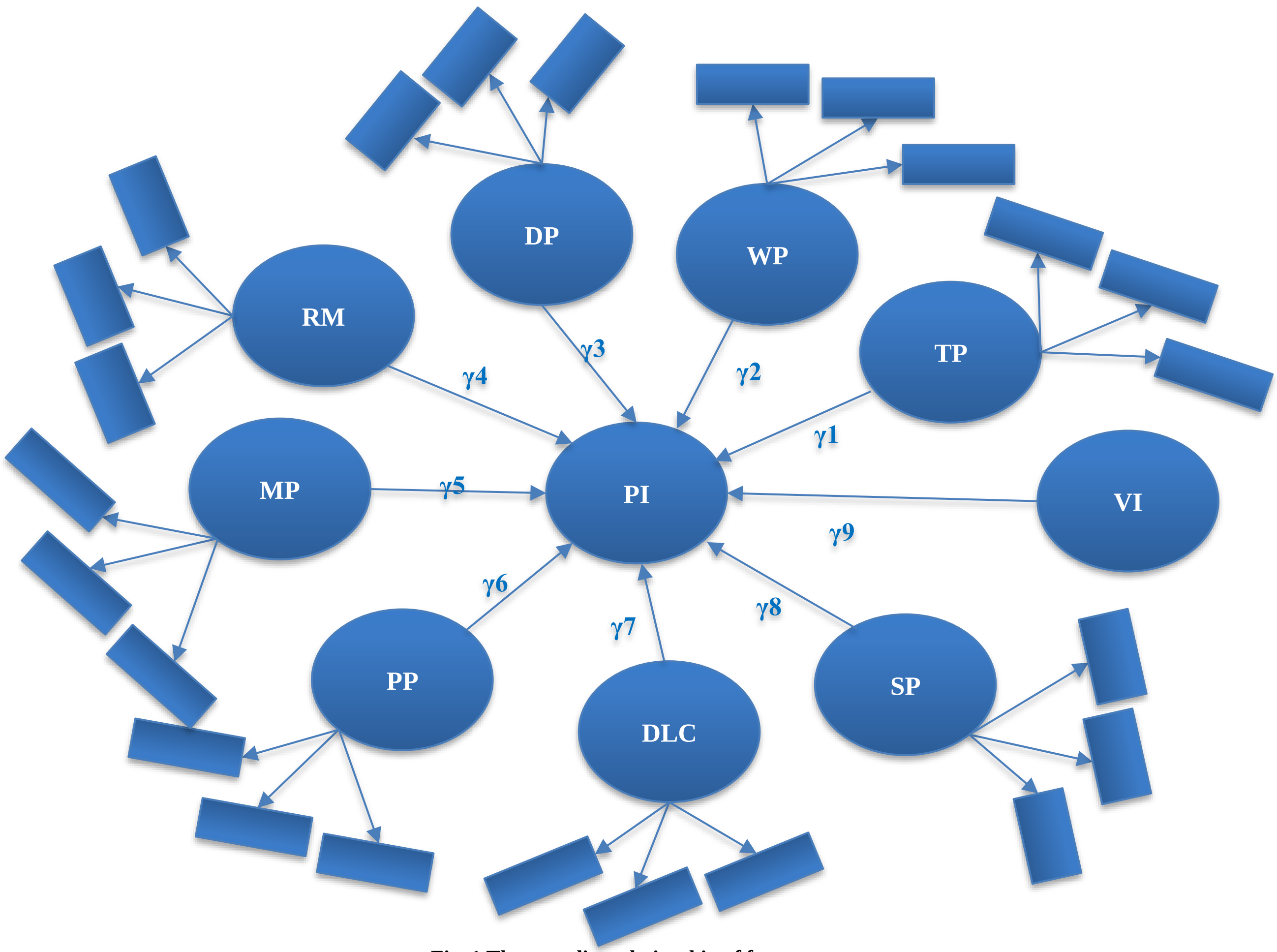

Fig. 1 The causality relationship of factors

4. Results

4.1. The Measurement Model

This research investigated the causal relationship and influence between endogenous constructs related to DGT performance and exogenous factors. Previous theories and research findings guided the development of a framework comprising variables, relationships, and boundaries. This framework was then translated to the research context to serve as the basis for data analysis using SEM [32]. As shown in Figure 1 and Table 2, 58 manifest variables and 8 exogenous latent variables were used in the analysis. The following is the structural model based on the constructed causality relationship:

$$PI = \gamma_1 TP + \gamma_2 WP + \gamma_3 DO + \gamma_4 RM + \gamma_5 MP + \gamma_6 PP + \gamma_7 DLC + \gamma_8 SP + \zeta \quad (1)$$

$$VI = \gamma_9 PI + \zeta \quad (2)$$

Where PI - DGT performance, VI - public value, TP - team performance domain, WP - work performance domain, DO - delivery performance domain, RM - a risk or uncertainty management performance domain, MP - the measurement performance domain, PP - is planning performance domain, DLC - development and life cycle performance domain, SP – stakeholder performance domain, γ - correlation between exogenous and endogenous variables, and ζ - measurement error in the structural equation.

The measurement model undergoes several tests, including (1) individual item reliability or outer loadings, (2) construct reliability, (3) average variance extracted and (4) discriminant validity or cross-loading. All standardized loading factors must be at least 0.5 [49]. Table 3 shows that all indicators are significant, as indicated by the estimated value of the outer loadings exceeding the 0.5 threshold. The Cronbach Alpha value was used to assess reliability, with a threshold of 0.7 indicative of good reliability [49]. All nine constructs met these criteria, indicating that they possess good reliability. This implied that the indicators used to measure the constructs exhibited accuracy, consistency, and precision.

Furthermore, the AVE test was performed, which required a minimum AVE value of 0.5 [49]. All constructs examined in this research satisfied this criterion, suggesting that the latent variables account for over half of the variance in the indicators on average. In order to ensure discriminant validity, a cross-loading test was also conducted to verify that each indicator effectively measured its corresponding construct. The results of these tests are shown in Tables 4, 5 and 6.

Table 2. Model-related constructs and indicators

Variable	Dimension	Indicator	Code	References
X1 (TP)	X11: Team Performance	The project team's communication	X111	[3], [33-36]
		The project team's shared vision and mission for the DGT project	X112	
		The awareness of project team members of their respective roles and responsibilities	X113	
		The mutual trust among the project team	X114	
	X12: Leadership	The capacity of leaders to establish and maintain project vision	X121	[3, 11, 33-40]
		The critical thinking of leaders	X122	
		The ability of leaders to motivate the project team	X123	
		The interpersonal values of organization leader	X124	
	X13: Management	The project's operational guidelines	X134	
	X14: Culture	The transparency among project team members	X141	
		The integrity of each project team member	X142	
X2 (WP)	X21: Efficiency & effectiveness	The compliance of the system to the design specifications	X211	[3], [17], [41-43]
	X22: Business Process Compliance	The conformity of the business process to the project design	X221	
		The influence of internal and external factors on changing business process	X222	
	X24: Resources Management	The comprehensive IT architecture: security, data, application, technology, and networking	X241	[17], [21], [42]
		Effectiveness and efficiency of resource utilization	X242	
	X25: Procurement management	The transparency, effectiveness, efficiency, and accountability of the procurement process	X251	[17], [21], [43]
		The vendor's performance	X252	
		The contract management performance	X253	
	X26: Knowledge management	The continuous DGT learning	X261	[44]
		The technology-based learning	X262	

X3 (DO)	X31: Requirement Compliance	Compliance of DGT services with policies, regulations and standard operating procedures	X311	[3], [24], [33], [36], [38]
	X32: Project Scope	The comprehensive project phase and scope of work	X321	[21]
	X33: Quality	The security system management	X332	[17]
		The complaint handling system	X334	
X4 (RM)	X41: Risk	The mapping of the external and internal environments	X411	[17], [33], [34]
		The responsiveness of the system to the adjustment required	X412	
		The risk management performance	X413	
	X42: Ambiguity	The decision-making accuracy	X422	
	X43: Complexity	The comprehensiveness of business processes	X431	[3], [24], [33], [36], [38]
	X44: Volatility	Organizational and system responsiveness to technological advances and policy changes	X441	
		The resilience of resources (finance, human resources, and IT infrastructure) to adapt to technology and regulatory changes	X442	[33], [34], [44]
X5 (MP)	X51: Deliverable	The performance of digital data and information services	X511	[17], [36], [42]
		The performance of interactive services	X512	
		The performance of transaction services	X513	
	X52: Services Level	The availability of key performance indicator	X521	
		The service level at each DGT stage	X522	
	X53: Projection	The projected resources (funding, human resources, IT infrastructure, and IT architecture) to achieve DGT goals and stages	X531	[3], [43]
	X54: Financial	The DGT project financing performance indicator	X541	
X6 (PP)	X61: Vision, Strategy, and Policy	The comprehensive DGT regulatory framework	X611	[3], [24], [33], [36], [38]
		The DGT's specific goals and objectives	X612	[17], [44]
		The information technology analysis to support organizational needs	X613	
		The information technology analysis to support end-user requirements	X614	
	X62: Organization	The DGT project organizational structure	X621	[11], [42], [45]
		The human resource assessment	X622	
	X63: Enterprise Architecture	The DGT implementation strategy	X631	[3], [24], [33], [36]
		The DGT enterprise architecture model	X633	
	X64: Communication	The communication, openness data and information standard	X641	[33]
X7 (DLC)	X71: Service development	The target outputs and outcomes of each development stage	X711	[3], [41], [42], [44]
	X72: Organization	The organizational DT culture program	X722	
		The capacity-building programs	X733	
X8 (SP)	X81: Stakeholder Mapping	The mapping of interoperable systems	X813	[18], [36], [41], [46]
		The mapping of users and beneficiaries	X814	
	X82: Stakeholder analysis	The stakeholder's authority	X821	
		The stakeholder's capability and competency	X822	
		The commitment of stakeholders	X823	
	X183: Stakeholder Involvement	The collaborative environment: internal and external stakeholders	X831	
		The effectiveness of communication management among stakeholders	X832	
Y1 (PI)		The application cohesiveness	Y11	[47]
		The security system performance	Y12	
		The system effectiveness	Y13	
		The system efficiency	Y14	
		The system interoperability	Y15	
		The accountability data	Y16	
Y3 (VI)	Y31: Service	Access to information	Y311	[3-6], [48]

	improvement	The transparency of the business services	Y312	
		The service time-saving	Y313	
		The service cost-saving	Y314	
		The security of public data and information	Y315	
		The inclusion, participation, and collaboration	Y316	
	Y32: Improving the effectiveness of government administration	The risk reduction of corruption and abuse of authority by civil servants	Y321	[4]
		The resource management	Y322	
		The data and information management	Y323	
		Good governance (systematic, efficient, effective, sustainable, flexible, lean, and agile operations)	Y324	
		The process and service performance	Y325	
		The collaboration, cooperation and communication between government agencies and the construction community	Y326	
		The institutional capacity building	Y327	
		The consistency in decision-making based on regulation and policy	Y328	
	Y33: Increasing the community's social value	Integrity and honesty	Y331	[7]
		Responsibility	Y332	
		Construction community interaction	Y333	

Table 3. Outer loadings test result

Indicator-Variable	Outer loadings	Indicator-Variable	Outer loadings	Indicator-variable	Outer loadings	Indicator-variable	Outer loadings
X111<- TP	0.758	X311 <- DO	0.868	X614<- PP	0.930	Y326 <- VI	0.873
X112 <- TP	0.798	X321<- DO	0.886	X621 <- PP	0.931	Y327 <- VI	0.890
X113<- TP	0.824	X332 <- DO	0.880	X622 <- PP	0.913	Y328 <- VI	0.879
X114<- TP	0.835	X334 <- DO	0.886	X631 <- PP	0.910	Y311 <- VI	0.833
X121<- TP	0.817	X411<- RM	0.905	X633 <- PP	0.871	Y11 <- PI	0.860
X122 <- TP	0.768	X412<- RM	0.909	X641 <- PP	0.867	Y12 <- PI	0.817
X123 <- TP	0.721	X413 <- RM	0.910	X711<- DLC	0.922	Y13 <- PI	0.887
X124 <- TP	0.677	X422 <- RM	0.880	X722<- DLC	0.937	Y14 <- PI	0.893
X134<- TP	0.680	X431 <- RM	0.894	X723<- DLC	0.941	Y15 <- PI	0.871
X141 <- TP	0.811	X441 <- RM	0.866	X813<- SP	0.898	Y16 <- PI	0.859
X142<- TP	0.840	X442 <- RM	0.872	X814 <- SP	0.907	Y312 <- VI	0.844
X211 <- PW	0.825	X511 <- MP	0.889	X82 <- SP	0.924	Y313 <- VI	0.854
X221 <- PW	0.858	X512 <- MP	0.887	X822 <- SP	0.928	Y314 <- VI	0.806
X222 <- PW	0.814	X513<- MP	0.866	X823 <- SP	0.927	Y315 <- VI	0.796
X241 <- PW	0.873	X521 <- MP	0.915	X831 <- SP	0.914	Y321 <- VI	0.821
X242 <- PW	0.876	X522 <- MP	0.899	X832 <- SP	0.910	Y331 <- VI	0.847
X251 <- PW	0.867	X531 <- MP	0.884	Y316 <- VI	0.829	Y332 <- VI	0.891
X252 <- PW	0.867	X541 <- MP	0.886	Y322 <- VI	0.878	Y333 <- VI	0.838
X253 <- PW	0.860	X611 <- PP	0.868	Y323 <- VI	0.881		
X261 <- PW	0.862	X612<- PP	0.919	Y324 <- VI	0.888		
X262 <- PW	0.892	X613 <- PP	0.910	Y325 <- VI	0.920		

Table 4. Construct reliability and Average Variance Extracted (AVE)

	Cronbach's alpha	Average variance extracted (AVE)		Cronbach's alpha	Average variance extracted (AVE)
TP	0.935	0.605	PP	0.971	0.815
PW	0.961	0.739	DLC	0.926	0.871
DO	0.903	0.774	SP	0.968	0.838
RM	0.957	0.794	PI	0.933	0.748
MP	0.956	0.791	VI	0.977	0.735

Table 5. The cross-loading test result of the DGT performance model

Indicator	TP	PW	DO	RM	MP	PP	DLC	SP	PI
X111	**0.758**	0.670	0.692	0.674	0.577	0.641	0.610	0.613	0.594
X112	**0.798**	0.695	0.693	0.653	0.604	0.618	0.604	0.628	0.539
X113	**0.824**	0.715	0.737	0.706	0.615	0.645	0.646	0.701	0.566
X114	**0.835**	0.672	0.713	0.657	0.581	0.621	0.590	0.633	0.508
X121	**0.817**	0.604	0.613	0.588	0.582	0.566	0.582	0.579	0.518
X122	**0.768**	0.558	0.539	0.533	0.512	0.485	0.524	0.523	0.463
X123	**0.721**	0.485	0.465	0.456	0.450	0.451	0.439	0.472	0.303
X124	**0.677**	0.419	0.455	0.431	0.443	0.395	0.412	0.435	0.292
X134	**0.680**	0.652	0.635	0.655	0.620	0.630	0.597	0.581	0.390
X141	**0.811**	0.744	0.680	0.745	0.641	0.706	0.714	0.670	0.521
X142	**0.840**	0.703	0.726	0.701	0.633	0.674	0.670	0.679	0.564
X211	0.731	**0.825**	0.792	0.776	0.718	0.754	0.766	0.709	0.653
X221	0.738	**0.858**	0.819	0.769	0.744	0.812	0.718	0.767	0.635
X222	0.675	**0.814**	0.748	0.704	0.727	0.718	0.706	0.706	0.547
X241	0.670	**0.873**	0.799	0.797	0.733	0.784	0.770	0.724	0.608
X242	0.727	**0.876**	0.791	0.811	0.778	0.773	0.802	0.711	0.629
X251	0.747	**0.867**	0.823	0.799	0.739	0.780	0.751	0.750	0.606
X252	0.707	**0.867**	0.783	0.752	0.760	0.741	0.771	0.712	0.644
X253	0.731	**0.860**	0.774	0.764	0.762	0.769	0.784	0.748	0.682
X261	0.676	**0.862**	0.792	0.827	0.794	0.799	0.785	0.756	0.612
X262	0.672	**0.892**	0.821	0.845	0.806	0.843	0.822	0.816	0.647
X311	0.705	0.797	**0.868**	0.753	0.761	0.759	0.700	0.726	0.627
X321	0.730	0.828	**0.886**	0.838	0.743	0.804	0.773	0.747	0.669
X332	0.721	0.796	**0.880**	0.759	0.710	0.707	0.694	0.732	0.662
X334	0.756	0.831	**0.886**	0.834	0.781	0.794	0.801	0.781	0.663
X411	0.766	0.844	0.833	**0.905**	0.835	0.861	0.825	0.813	0.643
X412	0.717	0.804	0.796	**0.909**	0.820	0.849	0.813	0.799	0.617
X413	0.763	0.839	0.826	**0.910**	0.813	0.846	0.848	0.827	0.641
X422	0.755	0.827	0.845	**0.880**	0.754	0.827	0.804	0.785	0.678
X431	0.704	0.799	0.827	**0.894**	0.766	0.813	0.818	0.799	0.636
X441	0.670	0.775	0.761	**0.866**	0.731	0.787	0.792	0.710	0.691
X442	0.665	0.806	0.751	**0.872**	0.782	0.832	0.802	0.805	0.571
X511	0.689	0.795	0.778	0.772	**0.889**	0.828	0.800	0.782	0.660
X512	0.685	0.763	0.766	0.763	**0.887**	0.761	0.755	0.774	0.715
X513	0.651	0.766	0.744	0.728	**0.866**	0.739	0.741	0.723	0.642
X521	0.648	0.801	0.756	0.797	**0.915**	0.832	0.818	0.819	0.685
X522	0.658	0.763	0.751	0.805	**0.899**	0.837	0.817	0.788	0.670
X531	0.655	0.804	0.751	0.818	**0.884**	0.859	0.810	0.813	0.628
X541	0.610	0.790	0.749	0.807	**0.886**	0.868	0.815	0.771	0.613
X611	0.721	0.800	0.799	0.818	0.770	**0.868**	0.802	0.788	0.649
X612	0.670	0.787	0.758	0.848	0.857	**0.919**	0.829	0.832	0.625
X613	0.659	0.821	0.767	0.851	0.860	**0.910**	0.854	0.833	0.610
X614	0.690	0.846	0.781	0.856	0.894	**0.930**	0.849	0.858	0.653
X621	0.688	0.834	0.796	0.863	0.834	**0.931**	0.849	0.833	0.668
X622	0.622	0.824	0.768	0.816	0.839	**0.913**	0.829	0.781	0.585
X631	0.717	0.833	0.824	0.850	0.842	**0.910**	0.843	0.851	0.629
X633	0.692	0.800	0.777	0.825	0.773	**0.871**	0.825	0.787	0.661
X641	0.748	0.799	0.795	0.838	0.787	**0.867**	0.832	0.787	0.639
X711	0.700	0.831	0.798	0.855	0.829	0.868	**0.922**	0.802	0.649
X722	0.739	0.830	0.788	0.850	0.840	0.847	**0.937**	0.815	0.695
X723	0.686	0.841	0.778	0.857	0.828	0.877	**0.941**	0.808	0.688
X813	0.664	0.771	0.735	0.784	0.782	0.821	0.783	**0.898**	0.597

X814	0.735	0.757	0.760	0.781	0.769	0.810	0.764	**0.907**	0.588
X821	0.721	0.781	0.774	0.804	0.796	0.835	0.792	**0.924**	0.631
X822	0.705	0.798	0.778	0.818	0.831	0.844	0.777	**0.928**	0.633
X823	0.713	0.790	0.792	0.811	0.819	0.812	0.792	**0.927**	0.605
X831	0.721	0.788	0.789	0.830	0.799	0.840	0.821	**0.914**	0.606
X832	0.699	0.828	0.808	0.851	0.831	0.839	0.820	**0.910**	0.649
Y11	0.456	0.566	0.583	0.564	0.560	0.548	0.557	0.517	**0.860**
Y12	0.605	0.648	0.665	0.595	0.655	0.611	0.594	0.612	**0.817**
Y13	0.494	0.575	0.606	0.580	0.609	0.547	0.595	0.525	**0.887**
Y14	0.622	0.694	0.709	0.692	0.705	0.666	0.713	0.622	**0.893**
Y15	0.424	0.576	0.600	0.581	0.570	0.573	0.579	0.522	**0.871**
Y16	0.660	0.706	0.682	0.700	0.724	0.692	0.704	0.671	**0.859**

Table 6. The cross-loading test result of the value creation model

Indicator	PI	VI		PI	VI		PI	VI		PI	VI
Y11	**0.860**	0.687	Y316	0.708	**0.829**	Y327	0.741	**0.890**	Y315	0.679	**0.796**
Y12	**0.817**	0.732	Y322	0.737	**0.878**	Y328	0.722	**0.879**	Y321	0.692	**0.821**
Y13	**0.887**	0.690	Y323	0.731	**0.881**	Y311	0.740	**0.833**	Y331	0.734	**0.847**
Y14	**0.893**	0.770	Y324	0.719	**0.888**	Y312	0.735	**0.844**	Y332	0.765	**0.891**
Y15	**0.871**	0.706	Y325	0.771	**0.920**	Y313	0.739	**0.854**	Y333	0.716	**0.838**
Y16	**0.859**	0.823	Y326	0.767	**0.873**	Y314	0.740	**0.806**			

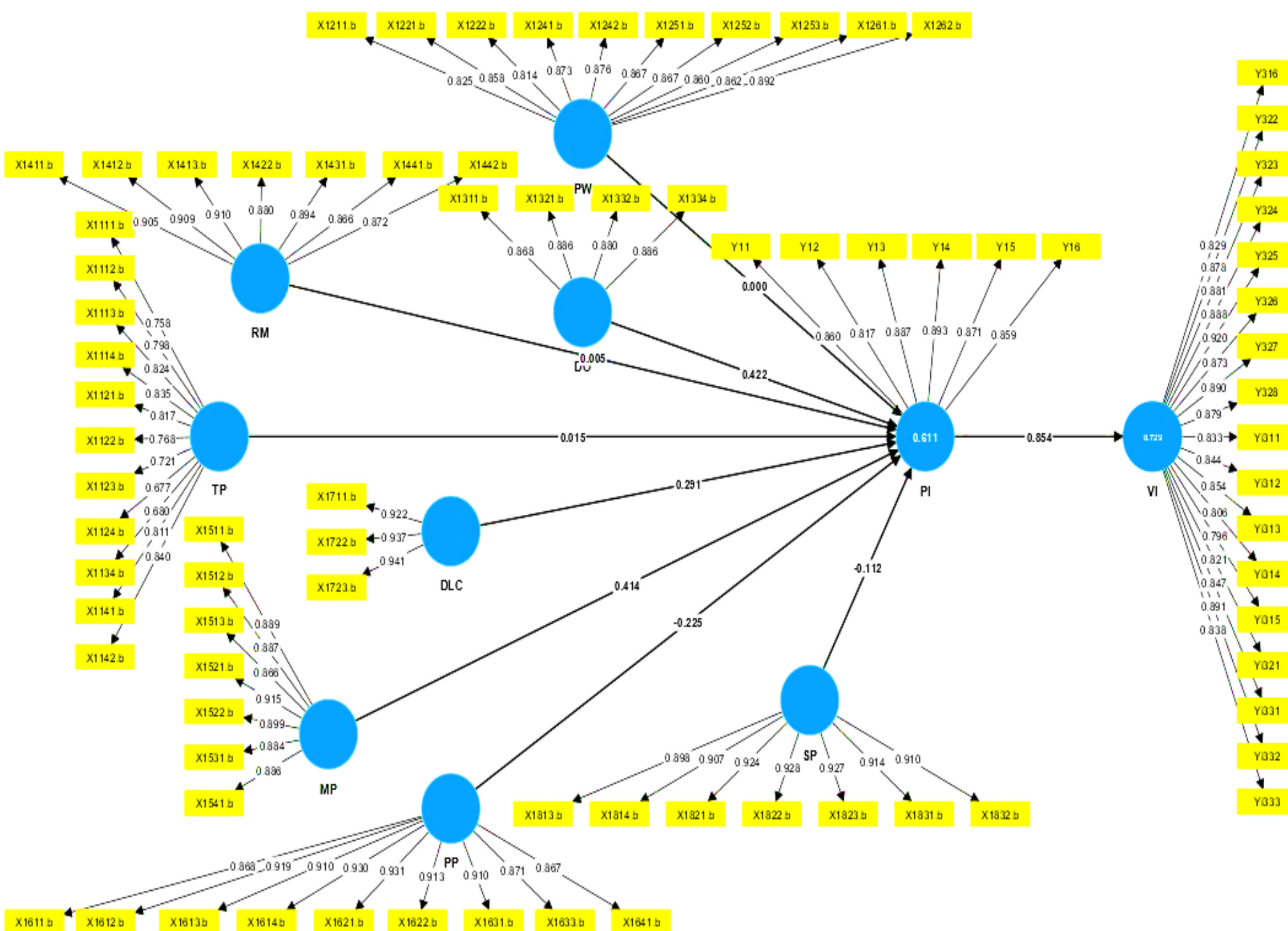

Fig. 2 SEM diagram of DGT performance and value creation model

Table 7. Output analysis of the DGT performance model

	Original sample (O)	Sample mean (M)	Standard Deviation (STDEV)	T-statistics (|O/STDEV|)	P values
TP -> PI	0.015	0.029	0.125	0.118	0.906
PW -> PI	0.000	0.001	0.201	0.001	0.999
DLC -> PI	**0.291**	0.282	0.174	1.675	0.094
DO -> PI	**0.422**	0.415	0.172	2.451	0.014
RM -> PI	0.005	0.016	0.178	0.030	0.976
MP -> PI	**0.414**	0.424	0.158	2.623	0.009
PP -> PI	-0.225	-0.241	0.212	1.065	0.287
SP -> PI	-0.112	-0.115	0.157	0.714	0.475
PI -> VI	0.854	0.854	0.033	26.105	0.000

Table 8. R-Square result of project performance model

	R-square	R-square adjusted
PI	0.611	0.587
VI	0.729	0.727

4.2. The Structural Model

Figure 2 shows an SEM diagram of the DGT performance and value creation model. The goodness of the model was evaluated by examining the significance level of the association between variables, determined based on the p-value (Table 7) and the R-square (Table 8). The resulting DGT performance and value creation model is stated as follows:

$$PI = 0.015TP + 0.00PW + 0.422DO + 0.005RM + 0.414MP - 0.255PP + 0.291DLC - 0.112SP + \zeta \quad (3)$$

$$VI = 0.854\, PI + \zeta \quad (4)$$

5. Discussion

The results of the CFA showed that the eight latent variables (unobserved) in the model were significantly formed by the 58 indicators that measured them. This significance was indicated by the outer loading values of each indicator, which exceeded the threshold of 0.5. Furthermore, the findings from the structural model indicated that several variables, including team, uncertainty or risk management, deliverable or output, measurement, and development approach and life cycle performances, exhibited a positive relationship with DGT performance. The adjusted R-square value, or the coefficient of determination, was found to be 0.587, indicating that approximately 58.7% of the changes in DGT performance could be explained by the eight exogenous variables in the model (TP, PW, DO, RM, MP, PP, DLC, and SP), while the remaining portion was influenced by variables not included in the model.

Three variables, namely deliverable or output, measurement, development approach and life cycle performance domain, showed a very strong positive relationship, implying improvements in these domains would significantly enhance DGT performance. Based on the findings of the preceding analysis, the use of digital technology only transforms a subset of public organizations. The strength of the deliverable or output performance domain indicated that achieving transformation required more than just the adoption of digital technology, and it necessitated attention to other project management variables. This present research emphasized the importance of the ability of an organization to achieve the desired project scope while maintaining a certain level of quality for successful DGT implementation. This was reflected in three dimensions of deliverable or output performance: compliance with policies, regulations, and standard operating procedures, attainment of project scope in each DGT project stage, and service quality. These findings were consistent with previous research, highlighting the need for a comprehensive approach to DGT development that included adherence to regulations and public policies [3, 24, 33, 36, 38, 50]. These regulations addressed changes brought about by the adoption of DGT policies. The deliverable performance domain also underscored the significance of effectively managing project phases and the scope of work, as step-by-step implementation was crucial during the system design and roll-out phases [3, 16, 41, 51]. Stakeholders should accept the change and new tools before it can be implemented.

The research findings showed that the measurement performance domain had a significant positive impact on project performance. This construct was closely related to project deliverables, how organizations could determine key performance indicators, measure service levels at each project phase, and efficiently manage existing resources. These findings aligned with previous research emphasizing the importance of setting target outputs for each phase, taking into account factors such as time, resources, risks, and the current conditions of the organizations as a baseline [17]. Defining clear key performance indicators and target services at each stage provided the foundation for effective project monitoring and evaluation, avoiding ambitious targets without a solid calculation basis. Furthermore, determining the service level in DGT projects held great significance, as highlighted in prior research, because it involved adapting and evolving from the initial to the final stage, fostering infrastructure and process flexibility [42]. This research was also in line with Sandoval-Almazán et al. [52] that the success of DGT depended on the ability of project owners to establish key performance indicators accounting for uncertainties emerging from the impact of technology on employment, as well as the community's reluctance to use new technology.

The development approach and life cycle performance are another significant factor that impacts DGT performance. It encompassed the development of DGT services in the project lifecycle, which could be approached predictively, adaptively, or in a hybrid manner depending on the clarity of the project and its level of uncertainty. Continuous development is essential for addressing service and organizational-related issues. Three important indicators that reflect the performance of this domain are 1) the flexibility of output and outcome target at each stage of the DGT project; 2) the organizational culture change programs (service-oriented, accountable, competent, harmonious, loyal, adaptive, and collaborative); and 3) the capacity building initiatives. The organization should be able to determine a development approach that would be used in the life cycle of the project. It varies across organizations and countries based on institutional characteristics and technology adoption levels [11]. These findings aligned with previous research that emphasized the need for social, cultural, and structural transformations to fully leverage the benefits of DGT [41, 53]. DGT projects involve a systemic transformation of life cycle stages with engagement from diverse stakeholders [20]. A systemic approach to modern project management methods and a thorough understanding of the multidimensionality of DGT projects are required [18]. Public organizations should continue emphasizing cultural and organizational change to carry out the digitization process effectively. Given the dynamic nature of technology in DGT projects, governments must continuously build technological capabilities in the project life cycle, keeping pace with advancements to meet evolving governance demands. Additionally, project managers need to develop contemporary managerial skills designed to the predictive or adaptive approach of specific organizations to ensure quality planning, implementation, and control of DGT projects.

The research findings showed a contrary relationship between the planning and stakeholder performance domains and implementation performance, contradicting previous reviews [15] and PMBOK theory. Hypotheses are tentative predictions based on existing literature and discrepancies between research outcomes. In addition, these could emerge due to variations in environments, variables, or the presence of unknown or uncontrollable factors. Further investigation with additional references and data is necessary to gain a deeper understanding of these topics.

The structural model also showed a strong relationship between DGT performance and the achievement of public value. The R-square adjusted value, or the coefficient of determination, of 0.727 indicated that the achievement of the public value could account for 72.7% of DGT performance. At the same time, other factors contributed to the remaining portion. This research examined public value creation through the perspective of digital system managers. It also confirmed the hypothesis based on previous research that project performance had a significant impact on public value creation, such as enhancement of the performance of government services [3–6], public administration [4], and social value [7, 8]. From the perspective of system managers, effective DGT project management is expected to provide benefits to the organization through easy access to information, process transparency, cost and time efficiency, stakeholder collaboration, and good governance. Factors such as integrity, responsibility, and effective communication among stakeholders in the construction sector contributed to inclusive business services. It is important to understand that public value in DGT projects encompasses the impact on government operations, actions, and policies, not solely limited to services provided to society [4, 41]. The outer loading values of the public value indicators implied no significant difference in the strength of tangible and intangible values, showing that both aspects had similar importance in reflecting the public value perspective of project managers.

This study surpasses existing benchmarks through its methodology and empirical analysis. The incorporation of an integrative approach, consisting of multiple performance domains, distinguishes it from conventional techniques reported in the literature. Notably, the study provides a detailed examination of the intricacies of DGT implementation. The high explanatory power of the model underscores its ability to clarify a substantial portion of DGT performance, exceeding state-of-the-art approaches. Furthermore, the study contributes by establishing a strong link between DGT performance and the attainment of public value, providing a more nuanced understanding of the broader implications of DGT initiatives.

6. Conclusion

In conclusion, this research developed a DGT implementation model based on performance domain factors and tested it using a survey conducted by an Indonesian DGT project team. The results highlighted the crucial role of indicators reflecting deliverable or output, measurement, development approach and life cycle performances as key factors in effective DGT project management. The structural model also showed a strong relationship between DGT implementation performance and the value achieved. One of the primary responsibilities of a DGT project manager was to ensure the presence of these factors in DGT project management in the construction sector. However, it is important to acknowledge that this research had limitations. Therefore, future investigations were recommended to enhance the existing evidence. The findings highlighted the importance of planning and stakeholder performance, contradicting previous research. Additionally, it is important to conduct additional investigation to explore deeper into this analysis and complement the survey results with in-depth interviews. To obtain comprehensive support for these topics, it would be necessary to gather more data and references. The number of constructs should be limited when using SEM methodology to test the results. This research focused primarily on cultural and structural indicators, while other potential indicators were overlooked. Furthermore, external factors such as political, economic, social, demographic, and geographical conditions influencing the sector were also excluded. Overcoming these limitations would require further research efforts.

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