

IRSTI 06.81.12
UDC 005.8:004.9:35(574)
JEL H83; M15; O22

<https://doi.org/10.46914/1562-2959-2026-1-3-473-490>

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STAKEHOLDER INTERACTION EVALUATION MODEL FOR AGILE TRANSFORMATION IN THE PUBLIC-SECTOR IT ENVIRONMENT

Abstract

This article creates and validates a Stakeholder Interaction Evaluation Model (SIEM) to evaluate and enhance stakeholder engagement during Agile transformation in a public-sector IT organization. The JSC “National Information Technologies” (NIT), the national operator of Kazakhstan’s e-government infrastructure, is the subject of the empirical case. To conform to the legal and procedural requirements of the public sector, the study presents a context-specific hybrid project management model that combines Agile methodologies with conventional plan-driven components. The study, which was based on a mixed-methods research design, used a two-phase data collection process: a pre-implementation baseline that includes surveys, stakeholder interviews, and documentary analysis, and a post-implementation phase that includes modified surveys, Jira process metrics, and retrospective analyses. Stakeholder groups were divided into three tiers according to operational proximity and strategic influence. The study employs predictive analytics to engagement-related data in addition to qualitative insights. A multiple linear regression model is introduced to forecast the effectiveness of stakeholder engagement based on metrics like sprint success rates, feedback responsiveness, and communication quality. According to the analysis, the hybrid approach enhanced project delivery consistency, role clarity, and communication effectiveness. The predictive model also detects early indicators of declining engagement, such as delayed feedback or reduced sprint completion, enabling proactive adaptation of the stakeholder strategy. The applied value of the study for Kazakhstan lies in the fact that the engagement dataset, the survey and interview instruments, the Jira metric set and the calibrated regression baseline were collected at NIT, the operator that delivers e-government projects for all state bodies, and can therefore be reused as reference values and a monitoring toolkit in similar digital projects of state bodies and quasi-public IT operators. In highly regulated IT environments, the research offers a useful, flexible framework for managing stakeholder dynamics and advancing effective digital transformation projects in the public sector.

Keywords: stakeholder engagement, hybrid project management, digital transformation, public sector, transparency, accountability, e-government.

Introduction

The importance of this study is supported by a number of significant factors. Initiatives in the public sector have increasingly started to use flexible management techniques like Agile and Scrum, often

in combination with conventional procedures. More timely and transparent stakeholder engagement throughout the project lifecycle is required by these contemporary approaches. There is a glaring lack of standardized frameworks for the quantitative and qualitative assessment of stakeholder participation in government agencies' current project management practices in Kazakhstan. This shortcoming makes it challenging to determine communication bottlenecks, evaluate stakeholder engagement objectively, or promptly modify interaction tactics as the project progresses.

A significant body of research shows that project success depends on systematic stakeholder engagement. Stakeholder theory treats stakeholder relationships as sources of strategic value rather than external constraints [1–3], and recent scholarship describes engagement as a dynamic process built on trust, accountability, transparency, and the quality of interaction between an organization and its stakeholder groups [4]. Ongoing digital transformation and the growing demand for public accountability in government services have further increased the need for frameworks that support the continuous evaluation and enhancement of stakeholder engagement [5–7]. Because government projects are under pressure to be transparent and responsive, agencies must involve stakeholders not only at the beginning of a project but also frequently and adaptably as it moves forward.

Effective stakeholder management is today essential to the success of IT government projects, and most organizations choose a hybrid approach that combines Agile practices with conventional project management techniques rather than fully implementing Agile. Gemino et al. concluded that hybrid is a leading project management approach after finding that most projects in their global sample combined Agile and traditional practices [8]; hybrid approaches were used in the majority of projects analyzed by Serrador and Pinto [9]; and industry surveys report that the share of projects delivered with hybrid approaches grew from 20% in 2020 to 31% in 2023 [10, 11]. Stakeholder coordination, project complexity, and project management effort are associated with performance outcomes in complex projects [12, 13], and continuous stakeholder involvement improves project results [14, 15]. Methodologically, hybrid models can draw on Disciplined Agile Delivery and Agile-Stage-Gate, which combine iterative delivery with milestone-based control [16, 17], while the coordinating role of the project manager remains essential for alignment across organizational levels [18, 19]. In the public sector, Agile adoption is shaped by procurement rules, hierarchical accountability, and risk aversion [20], and e-government failures are more often rooted in organizational and coordination problems than in technical deficits [21]. Governance instruments such as the Canadian Management Accountability Framework and the European Common Assessment Framework, both of which Kazakhstan has drawn upon in its public administration reforms, show how accountability, service delivery, and stakeholder-centered evaluation can be integrated into public IT projects [22–24].

Although the influence of stakeholders on success is acknowledged in theory, project managers in the public sector still lack tools to monitor and manage engagement on an ongoing basis, and in most organizations its evaluation is restricted to formal check-ins or subjective assessments. In public-sector projects, where stakeholder engagement has a direct impact on implementation speed, legal compliance, citizen satisfaction, and process transparency, this gap is particularly noticeable. The success of cross-functional collaboration, the level of stakeholder participation, and the quality of communication are frequently overlooked by traditional project evaluation criteria that are centered on schedules, budgets, and deliverables. Lack of a systematic approach to evaluate stakeholder engagement can have a number of detrimental effects, including postponed decision-making, conflicts of interest, eroded participant trust, decreased productivity, and ultimately, a compromised level of project outcomes.

The goal of this work is to create and empirically validate the Stakeholder Interaction Evaluation Model (SIEM), a methodical framework for evaluating and continuously enhancing stakeholder engagement in public sector projects that integrate Agile and traditional project management components (hybrid approach).

The object of the study is the project management system of a public-sector IT organization undergoing Agile transformation; the subject is the interaction between stakeholders at operational, managerial, and strategic levels. The study covers mid-level managers, senior executives, project managers, and project team members (developers, business analysts, product owners, and other Agile role-holders) involved in a digital transformation project delivered with a hybrid Agile–traditional methodology. The research hypothesis is that the introduction of a hybrid model supported by

structured engagement metrics measurably improves stakeholder engagement, and that engagement effectiveness can be predicted from a small set of process and perception indicators. The novelty of the work lies in the integrated three-layer evaluation model itself and in its validation through regression analysis of stakeholder interaction dynamics using actual project data. The practical significance for Kazakhstan is twofold: the study delivers a replicable monitoring instrument for public-sector IT projects that must combine Agile responsiveness with formal accountability, and it produces an empirical dataset collected at the national e-government operator that can serve as a reference base for similar digital projects of state bodies and quasi-public IT organizations.

Statistical overview of the research context

The relevance of the problem is confirmed by the scale and pace of digital government development in Kazakhstan. According to the United Nations E-Government Survey, the country has moved from 39th place in 2018 to 24th place among 193 member states in 2024, with an E-Government Development Index (EGDI) of 0.9009, ranking 10th in the world on the Online Service Index and first among landlocked developing countries [25, 26]. The dynamics of the index are summarized in table 1.

Table 1 – Position of Kazakhstan in the UN E-Government Development Index, 2018–2024

Survey year	EGDI value	Global rank (of 193)	Change in rank vs. previous survey
2018	0.7597	39	–6
2020	0.8375	29	+10
2022	0.8628	28	+1
2024	0.9009	24	+4
Note: Compiled by the authors based on [25, 26].			

Growth in the index has been accompanied by a rapid expansion of service delivery through the e-government infrastructure operated by NIT. In 2025 more than 51.5 million public services were delivered online, of which almost half were obtained through the eGov Mobile application; the portal had more than 15.1 million registered users, the mobile application 11.7 million users and 6.4 million monthly active users, and about 90% of public services were available in electronic form [27]. Every one of these services depends on IT projects that involve ministries, the national operator, contractors, and citizens as stakeholders. At the same time, the international evidence shows that project performance varies only marginally between predictive, Agile, and hybrid approaches (an average success rate of about 74% in 2024), which means that organizational factors such as stakeholder alignment and communication, rather than the choice of methodology alone, determine outcomes [11].

The policy framework of Kazakhstan makes this gap directly relevant to practice. The Concept of Digital Transformation, Development of the ICT Industry and Cybersecurity for 2023–2029 sets targets for the proactive and composable delivery of public services and requires state bodies to implement digitalization initiatives on a project basis with measurable results [28]. The Development Plan of JSC “National Information Technologies” for 2024–2033, approved by the Government, assigns NIT the role of the single integrator of e-government projects for all central and local state bodies, which means that the coordination of dozens of institutional stakeholders is a permanent, not an episodic, task of the company [29]. Against this background, the absence of a standardized instrument for measuring stakeholder interaction in Kazakhstan’s public IT projects is a substantive gap, and data collected inside the national operator are the most representative empirical base for closing it.

Materials and methods

In government settings, where strict administrative structures must coexist with the flexible and iterative components brought about by Agile practices, managing diverse stakeholder groups is a challenge. To triangulate findings, a mixed-methods approach was used, integrating qualitative insights and quantitative measurements from several sources. This made it possible for the study to record both the quantifiable results and the experiential aspects of stakeholder engagement.

Research context. The state-owned company JSC “National Information Technologies” (NIT), which creates and operates Kazakhstan’s e-government infrastructure, serves as the empirical setting for this investigation [30]; in addition to its public annual reports, unpublished internal project documentation of the company for 2020–2023 was used. The study used a two-phase data collection strategy based on methodological triangulation. The first phase (pre-hybrid baseline) involved analyzing internal documents – departmental performance reports and quarterly plans for 2022 and early 2023 – to identify past trends in task completion, bottlenecks, and communication flows, together with an initial round of structured stakeholder surveys focused on role clarity, responsiveness, and coordination. The second phase involved gathering performance metrics from the Jira platform (sprint velocity, cycle time, backlog movement, and task resolution rate over 12 consecutive sprints), semi-structured interviews, and repeated stakeholder surveys to evaluate gains in engagement, collaboration, and satisfaction.

Survey instrument. Both Likert-scale and open-ended questions were included in the survey design, allowing for both qualitative investigation of stakeholder experiences and quantitative assessment of engagement factors. Out of the approximately 120 Agile practitioners who were eligible, 80 people filled out structured surveys, yielding a 67% response rate. Technical experts and managerial staff were evenly distributed throughout the sample, reflecting a range of organizational viewpoints and tenure durations from less than a year to more than six years. To guarantee a consistent comparison of perceptions over time, the same people were asked to take part in both phases. Five engagement dimensions were measured: role understanding, feedback responsiveness, cross-departmental collaboration, planning engagement, and overall collaboration effectiveness; the proportion of respondents rating a dimension 4 (agree) or 5 (strongly agree) was used as the engagement measure.

Interviews. To provide rich, context-sensitive insights, 15 semi-structured interviews were conducted at various organizational levels to supplement the surveys and Jira data. Cross-functional team members, senior developers, department heads, and project managers were among the interviewees, selected by maximum variation sampling within the purposive framework. The interviews investigated perceptions of Agile cultural adaptation, role ambiguity, feedback loop maturity, communication practices, and stakeholder alignment. With participant consent, each session was recorded and lasted 45 to 60 minutes, either in-person or online. A deductive framework based on Agile transformation research and stakeholder theory was used to apply thematic analysis to the transcripts.

Process metrics. Sprint-level metrics were extracted from Jira for twelve consecutive sprints in departments that were actively using Agile practices: Sprint Velocity (story points completed per sprint), Cycle Time (time from task creation to task closure), Backlog Movement (tasks completed per sprint), and Resolution Rate (percentage of completed tasks compared to planned tasks). Process-oriented measurement of task flows, cycle times, and feedback loops creates measurable conditions for evaluating collaboration. Pre-implementation counterparts of these indicators were reconstructed from quarterly task reports for 2023.

Sampling and ethics. Purposeful sampling was used to make sure that participants had firsthand knowledge of Agile procedures and actively participated in NIT’s stakeholder coordination initiatives; the sampling plan was designed to mirror the three-tiered stakeholder architecture of the model. The Graduate Research Committee at Astana IT University provided ethical approval before data collection started; every participant was informed about the goal of the study and the voluntary nature of participation, and informed consent was obtained prior to any survey or interview. The anonymized dataset (survey responses, coded interview themes, and sprint-level Jira metrics) is stored in the project archive of grant AP26102429 and can be made available to state bodies and researchers on request in a form that does not disclose personal data or restricted project information.

Statistical analysis. Pre- and post-implementation indicators were compared as percentage-point and relative changes; sprint trends were described by linear regression on the sprint number. The predictive component of the model was tested with a multiple linear regression (enter method) of an engagement effectiveness score on five predictors using 80 post-implementation observations; assumptions were checked through correlation analysis (all pairwise $|r| < 0.7$ among predictors) and residual inspection. Calculations were performed in Microsoft Excel.

Results and discussion

Pre-implementation diagnosis

Prior to the adoption of Agile practices and the SIEM, semi-structured interviews were carried out with a purposive sample of 15 employees from various departments within NIT in order to supplement the survey data. The interview guide focused on five areas of stakeholder interaction: understanding of roles, feedback mechanisms, communication across departments, participation in planning, and overall collaboration satisfaction. The thematic analysis is summarized in table 2.

Table 2 – Thematic summary of pre-implementation stakeholder interaction challenges

Theme	Representative interview quote	Frequency (of 15)
Role ambiguity (role understanding)	«I often don't know who approves tasks.»	9/15 (60%)
Feedback gaps (feedback responsiveness)	«There's no feedback loop, especially between teams.»	11/15 (73%)
Communication issues (cross-department collaboration)	«Meetings happen, but updates don't reach everyone.»	10/15 (67%)
Top-down planning (planning engagement)	«Higher-ups make most of the decisions; we are not consulted.»	8/15 (53%)
Fragmented collaboration (overall collaboration)	«It's not really collaborative; each department just concentrates on its own tasks.»	7/15 (47%)
Note: Compiled by the authors based on the results of semi-structured interviews.		

Role clarity was one of the main concerns: 60% of interviewees were unsure of who was in charge of making decisions about projects or approving tasks, and the absence of formalized role descriptions produced delays, overlapping duties, and accountability gaps. The lack of efficient feedback loops was the dominant theme (73%), leading to late-stage problem detection and slow adaptability. Two-thirds of participants reported poor communication structures: meetings were regularly scheduled but procedural rather than substantive, and important updates frequently did not reach all parties. More than half (53%) stated that senior management was largely in charge of planning, which is reflected in the low planning engagement score (46%) of the baseline survey, and almost half (47%) described departmental collaboration as fragmented, consistent with the baseline overall collaboration score of 44%.

Overall, the Phase 1 interviews consistently depicted a low-engagement setting: unclear roles, fragmented communication, broken feedback loops, and a sense of exclusion from planning among stakeholders. These qualitative observations confirm the baseline diagnosis of systemic engagement deficiencies by triangulating with the survey data.

To measure workflow efficiency before SIEM, operational performance records from the pre-Agile era were examined in addition to perceptual data. Internal quarterly task reports covering four consecutive quarters in 2023 were reviewed for tasks planned, tasks completed, average cycle time, and resolution rate (table 3).

Table 3 – Pre-implementation task metrics from document analysis, 2023

Period	Tasks planned	Tasks completed	Avg. cycle time (days)	Resolution rate (%)
Q1 2023	80	55	9.5	68.0
Q2 2023	75	50	9.8	66.7
Q3 2023	90	62	9.3	68.9
Q4 2023	85	59	9.7	69.4
Total / average	330	226	9.6	68.3
Note: Compiled by the authors based on internal quarterly task reports of NIT [30].				

Only 68.3% (roughly two-thirds) of the planned tasks were completed on average each quarter, and the narrow range of quarterly values (66.7–69.4%) points to a systemic execution ceiling rather than random variation. Tasks took more than a week on average to close, and the stable cycle time

across quarters indicates inherent process bottlenecks. In total, 104 of 330 planned tasks (31.5%) remained in the backlog at the end of the year. These quantitative workflow deficiencies support the interview findings of slow feedback and coordination problems and provided the justification for applying Agile techniques in conjunction with the SIEM framework.

Post-implementation results

The redesigned process, with Agile and SIEM integration, established a structured yet flexible approach to stakeholder engagement and task management. Roles and responsibilities were clearly defined through stakeholder mapping and a RACI matrix; sprint planning, daily stand-ups, and retrospectives were introduced to foster regular interaction and real-time feedback; and interdepartmental collaboration was strengthened through shared planning boards, transparent task tracking in Jira, and scheduled synchronization checkpoints. Sprint 1 serves as the baseline at the beginning of the hybrid model's implementation and Sprint 12 shows the situation after its consistent application (table 4).

Table 4 – Jira process metrics over 12 sprints after implementation of the hybrid model

Sprint	Velocity (story points)	Tasks planned	Tasks completed	Resolution rate (%)	Avg. cycle time (hours)
1	20	8	6	75.0	20
2	23	8	7	87.5	19
3	26	9	8	88.9	18
4	27	9	8	88.9	17
5	30	10	9	90.0	16
6	31	10	9	90.0	15
7	34	11	10	90.9	14
8	35	11	10	90.9	13
9	38	12	11	91.7	12
10	39	12	11	91.7	11
11	42	13	12	92.3	10
12	45	13	13	100.0	9
Total / average	–	126	114	89.8	14.5

Note: Compiled by the authors based on Jira sprint data of NIT.

Sprint velocity increases steadily from 20 to 45 story points (+125%), the resolution rate improves from 75% to 100% of planned tasks, average cycle time falls by more than half (from 20 to 9 hours per task), and backlog movement more than doubles (from 6 to 13 tasks per sprint). A linear trend fitted to the sprint data gives an average gain of 2.1 story points per sprint ($R^2 = 0.99$) and a reduction in cycle time of exactly one hour per sprint, i.e. the improvement was continuous rather than a one-off jump after the transition. Over the twelve sprints 114 of 126 planned tasks were completed (90.5%).

Stakeholder survey results indicated significant increases in engagement across all five dimensions following the adoption of the hybrid Agile-SIEM model supported by Jira metrics. Table 5 contrasts the baseline and post-implementation share of positive responses (“agree” or “strongly agree”) for every engagement dimension.

About three-quarters or more of respondents gave positive ratings in every category following the hybrid model, compared to an average of about half in the baseline survey. The average positive rating rose from 45.4% to 76.0% (+30.6 percentage points, or two-thirds in relative terms). The largest absolute gain was in role understanding (+33 pp), directly attributable to the introduced Scrum roles and RACI matrix, while the largest relative gains were in overall collaboration (+73%) and planning engagement (+70%), the two dimensions that had been most affected by top-down planning. Feedback responsiveness, although it improved by 29 pp, remained the lowest-rated dimension after implementation (71%), which indicates that inter-team feedback loops are the slowest element of the engagement system to mature.

Table 5 – Stakeholder engagement metrics before and after implementation of the hybrid SIEM model (n = 80)

Engagement dimension	Baseline positive (%)	Post-implementation: agree / strongly agree (n)	Post-implementation positive (%)	Change (pp)	Relative change (%)
Role understanding	52	50 / 18	85	+33	+63
Feedback responsiveness	42	42 / 15	71	+29	+69
Cross-department collaboration	43	42 / 14	70	+27	+63
Planning engagement	46	47 / 15	78	+32	+70
Overall collaboration	44	45 / 16	76	+32	+73
Average of five dimensions	45.4	–	76.0	+30.6	+67
Note: Compiled by the authors based on the results of the stakeholder surveys.					

A comparative thematic analysis of the pre- and post-implementation interviews (15 participants in each phase) confirms these shifts (table 6).

Table 6 – Thematic comparison of interview results before and after implementation

Engagement theme	Pre-implementation insight (share of interviewees)	Post-implementation insight (share of interviewees)	Change summary
Roles and responsibilities	“I often don’t know who approves tasks.” (60%)	“Now everyone knows exactly what their job is.” (80%)	Clearer roles via Scrum roles and RACI matrix
Feedback loops	“There’s no feedback loop, especially between teams.” (73%)	“We address client feedback every sprint.” (67%)	Faster, iterative loops through Agile ceremonies
Stakeholder inclusion	“Decisions are made above us; we just get told later.” (47%)	“Now we’re in the room helping shape the plan.” (73%)	Broader participation enabled by sprint planning
Cross-department collaboration	“Each department just focuses on its own tasks.” (67%)	“We now coordinate directly across units.” (60%)	Cross-functional reviews improved communication
Adaptability to change	“Any change request felt like a huge disruption.” (53%)	“We can pivot quickly when priorities shift.” (53%)	Agile iterations allowed structured flexibility
Note: Compiled by the authors based on the results of semi-structured interviews.			

Following the model’s implementation, 80% (12/15) of participants said they understood their roles clearly; 67% reported quick, iterative communication loops backed by sprint reviews and frequent stand-ups; and the share of stakeholders reporting involvement in planning decisions rose from 47% to 73%. Interviewees valued being consulted during decision-making or invited to planning sessions, which reflected a shift in culture toward inclusivity, and emphasized improved adaptability to change, since iterative planning allowed the project to change direction when new requirements arose.

Comparative analysis of task efficiency

Two key performance indicators – Average Cycle Time and Resolution Rate – were chosen for direct comparison between the conventional and hybrid regimes, because they could be measured both in the conventional quarterly reporting system and in Jira’s sprint-based tracking. The baseline values were obtained by averaging the four quarterly observations of 2023:

$$\text{Average cycle time (pre)} = (9.5 + 9.8 + 9.3 + 9.7) / 4 = 9.6 \text{ days} \quad (1)$$

$$\text{Resolution rate (pre)} = (68.0 + 66.7 + 68.9 + 69.4) / 4 = 68.3\% \quad (2)$$

After deployment, average cycle time in the raw sprint data was 14.5 hours per task, which equals 1.81 working days assuming an 8-hour working day. In summary comparisons, however, a rounded, conservative estimate of 3.0 days was used to account for variability, adaptation time, and realistic team adjustment periods; this modification reduces the possibility of overestimating the model's efficacy based on early peak performance. The post-implementation resolution rate is the mean of the twelve sprint values in table 4 (89.8%). The comparison is summarized in table 7.

Table 7 – Resolution rate and cycle time: conventional vs. hybrid Agile-SIEM model

Metric	Conventional (2023 average)	Hybrid Agile-SIEM (12-sprint average)	Absolute change	Relative change (%)
Average cycle time (days)	9.6	3.0 (conservative; 1.81 observed)	–6.6 days	–69
Resolution rate (%)	68.3	89.8	+21.5 pp	+31
Note: Calculated by the authors based on Tables 3 and 4.				

Even under the conservative assumption the hybrid model shortened task completion by 69% and raised the share of planned tasks completed by 21.5 percentage points. The gain in reliability is as important as the gain in speed: from Sprint 5 onwards every sprint delivered at least 90% of planned work, whereas no quarter under the conventional regime exceeded 70%. The two indicators also move together: sprints with higher resolution rates have shorter cycle times ($r = -0.80$), which is consistent with the mechanism of Agile feedback loops, sprint discipline, and task transparency producing more predictable planning and delivery. Agile adoption in government has likewise been associated with faster delivery and closer cooperation between IT and business units where it is adapted to institutional constraints [20], and for hybrid projects generally, where the combination of flexibility with formal control is associated with higher success [8, 9].

Stakeholder Interaction Evaluation Model

In order to methodically address engagement issues at different levels of public-sector IT projects, this study presents a three-layer architecture. It divides stakeholders into inner, middle, and outer layers according to their role and impact on the project. Using both quantitative and qualitative metrics, each layer is evaluated according to particular engagement dimensions, with well-defined target values to direct development.

The inner layer consists of direct project participants; its metrics make sure that hybrid delivery teams follow formal expectations and cross-functional accountability procedures in addition to working effectively in sprints. The middle layer comprises coordination stakeholders who serve as intermediaries between operational execution and strategic intent, and its metrics support both horizontal and vertical engagement coherence. The outer layer includes external decision-makers whose regular participation is guaranteed through strategic checkpoints and stage-gate reviews. Iterative retrospectives are extended and codified at every level, so that participation is continuously tracked, enhanced, and matched with changing project and institutional requirements. A systematic satisfaction index monitors stakeholder satisfaction with communication systems and decision-making outcomes, and feedback is collected and reviewed at each project cycle to prevent the accumulation of unresolved problems. The evaluation dimensions, metrics, methods, and target values for each layer are summarized in table 8.

SIEM is a cyclical, multi-phase model that goes through four iterative stages (figure 1). Input Diagnosis compiles baseline information on roles, expectations, and communication gaps from legacy reports, pre-hybrid surveys, and interviews. Hybrid Transformation and Role Definition introduces or reinforces Agile practices (Scrum ceremonies, backlog ownership) together with traditional governance components such as stage gates, documented approval points, and role accountability charters, so that flexibility at the team level coexists with organizational compliance. Post-Hybrid Metrics Collection gathers quantitative and qualitative data through surveys, interviews, and Jira analytics (cycle time, velocity, resolution rate). Iterative Improvements compares outcomes with the target values, and the resulting role modifications, meeting frequency adjustments, or communication updates feed the next Input Diagnosis stage.

Table 8 – Evaluation dimensions, metrics, and target values of the SIEM by stakeholder layer

Layer (stakeholders)	Evaluation dimension	Metric	Evaluation method	Target value
Inner (developers, business analysts, Scrum Masters, product owners)	Role clarity	% of team with clear role understanding	Survey (Likert)	≥ 80% score 4–5
	Collaboration quality	Avg. story points per sprint	Jira metrics	≥ planned target
	Feedback responsiveness	% feedback addressed per sprint	Jira + retrospectives	≥ 90%
	Interaction satisfaction	Average satisfaction score	Anonymous surveys	≥ 4 out of 5
Middle (delivery managers, department heads, team leads)	Strategic alignment	% of tasks aligned with unit goals	Documents + manager survey	≥ 75%
	Communication frequency	Frequency of updates / meetings	Calendar and logs	≥ twice a week
	Feedback adoption	% of upward feedback accepted	Interviews / retrospectives	≥ 60%
	Interlevel coordination	Avg. coordination score between layers	Cross-level surveys	≥ 4 out of 5
Outer (executive sponsors, government officials, regulators)	Decision-making involvement	Participation in key meetings	Meeting records	≥ biweekly
	Timeliness of feedback	Avg. time to approve / respond	Change request tracking	< 5 working days
	Trust in execution	Avg. trust / satisfaction score	Interviews / surveys	≥ 4 out of 5
	Goal alignment with strategy	% of project goals aligned with national strategy	Document analysis	≥ 80%

Note: Developed by the authors.

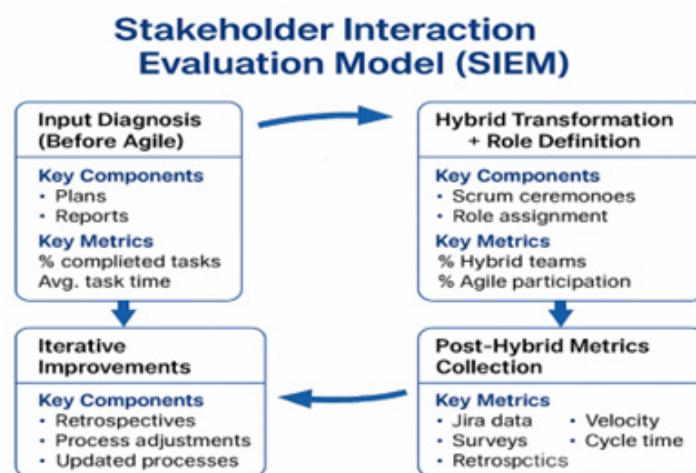


Figure 1 – Stakeholder Interaction Evaluation Model (SIEM)

Note: Developed by the authors.

Predictive analysis of the SIEM model

This section empirically assesses SIEM's predictive power by examining how its key components affect the overall effectiveness of stakeholder engagement. The dependent variable, Stakeholder

Engagement Effectiveness, was constructed from five survey-based dimensions (1 = strongly disagree, 5 = strongly agree): role clarity, feedback responsiveness, communication quality, planning involvement, and collaboration effectiveness. The scores were averaged and normalized to a 0–100 scale:

$$\text{Engagement score} = (\text{sum of 5 items} / 5) \times 20 \quad (3)$$

The independent variables were Role Clarity and Feedback Responsiveness (survey, 1–5), Communication Quality (openness and regularity of information sharing, survey, 1–5), Sprint Velocity (story points completed per sprint), and Resolution Rate (% of planned tasks completed per sprint). These predictors combine quantitative system data and qualitative survey inputs, which is consistent with the hybrid nature of the SIEM framework. The dataset comprised 80 post-implementation observations. Before the regression was run, all variables were examined for distributional issues and multicollinearity: the intercorrelations between the independent variables were moderate (all pairwise $|r| < 0.7$), although Sprint Velocity and Resolution Rate each correlate strongly with engagement ($r \approx 0.85$), so the model can distinguish their individual effects. Table 9 summarizes the regression coefficients.

Table 9 – Regression coefficients for predicting stakeholder engagement effectiveness (n = 80)

Predictor	Coefficient	Std. error	t-statistic	p-value
(Constant)	–15.190	4.276	–3.553	0.001
Role clarity (1–5)	0.223	0.528	0.422	0.674
Feedback responsiveness (1–5)	0.044	0.502	0.088	0.930
Communication quality (1–5)	1.259	0.461	2.734	0.008
Resolution rate (%)	0.645	0.081	8.001	< 0.001
Sprint velocity (points)	1.189	0.137	8.671	< 0.001
$R^2 = 0.871$; adjusted $R^2 = 0.862$; $F(5, 74) = 99.93$; $p < 0.001$				
Note: Calculated by the authors based on survey and Jira data.				

The five predictors jointly explain 87.1% of the variation in engagement effectiveness (adjusted $R^2 = 0.862$), and the F-test confirms that the full set of predictors significantly improves the forecast compared to a null model. Three of the five predictors are statistically significant. Communication Quality has a coefficient of 1.259 ($p = 0.008$): every one-point increase on the 5-point scale raises the predicted engagement score by about 1.26 points when all other variables are held constant. Resolution Rate has a coefficient of 0.645 ($p < 0.001$): a 20-percentage-point improvement (for example from 60% to 80%) is associated with an increase of roughly 12.9 points in engagement, which supports the hybrid approach’s focus on completing a significant amount of scheduled work in every cycle. Sprint Velocity has the largest t-statistic (coefficient 1.189, $p < 0.001$): a 10-point increase in velocity, of the order observed after the model’s adoption (from about 25 to 35 story points), corresponds to an increase of about 11.9 engagement points. Stakeholders therefore respond most strongly to Agile’s hallmarks of quicker value delivery and frequent incremental releases.

Role Clarity (coefficient 0.223, $p = 0.674$) and Feedback Responsiveness (0.044, $p = 0.930$) were not significant. The most plausible explanation is range restriction: by the time of the post-implementation measurement both indicators had improved uniformly across teams (role clarity from 52% to 85% positive, feedback timeliness by about 29 pp), so they no longer discriminate between more and less engaged respondents. Role clarity appears to act as a hygiene factor – a prerequisite that enables other drivers rather than a continuous engagement lever – and feedback responsiveness exerts its influence indirectly, through better sprint outcomes and higher resolution rates that the model already captures. Both variables were nevertheless retained to preserve the theoretical integrity of the SIEM framework. The estimated model is:

$$\hat{E} = -15.19 + 0.223 \cdot RC + 0.044 \cdot FR + 1.259 \cdot CQ + 0.645 \cdot RR + 1.189 \cdot SV \quad (4)$$

where $\hat{E}$ is the predicted engagement score (0–100), RC is role clarity, FR is feedback responsiveness, CQ is communication quality, RR is resolution rate (%), and SV is sprint velocity (story points). Applied to the observed improvements, the model attributes the largest part of the engagement gain to delivery performance: the rise in resolution rate from 78% to 92% contributes about 9.0 points and the rise in velocity from 28 to 35 story points about 8.3 points, while a one-point improvement in communication quality adds 1.3 points. Predicted engagement scores were calculated for each of the 80 observations and compared with the actual survey-based scores; Table 10 lists five representative observations and figure 2 plots them against the 45-degree line of perfect agreement.

Table 10 – Comparison of actual and predicted engagement scores (selected observations)

Observation	Actual (%)	Predicted (%)	Residual (pp)	Comment
1	70.1	78.9	–8.8	Over-predicted
2	78.0	78.0	0.0	Exact
3	80.0	81.0	–1.0	Slight over-prediction
4	88.9	84.6	+4.3	Under-predicted
Note: Calculated by the authors based on the regression model (equation 4).				

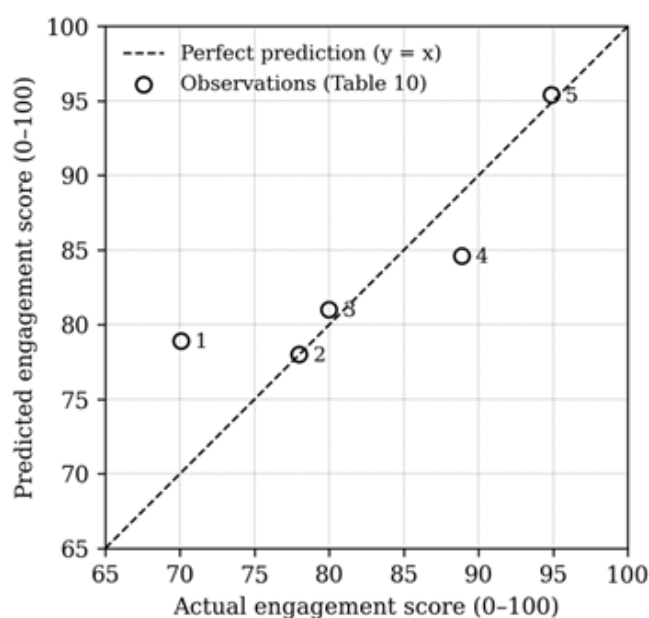


Figure 2 – Predicted versus actual engagement scores for the observations in Table 10

Note: Compiled by the authors based on the regression model (equation 4).

The close correspondence between actual and predicted scores (mean absolute residual of 2.9 points for the observations in Table 10) confirms the regression model's efficacy as a forecasting tool and shows that the selected metrics capture the dynamics of engagement. The absence of systematic bias in the residuals across the full sample supports the linear specification. Deviations reveal the model's boundaries: under-predictions point to variables outside the model, such as team morale or planning participation, while over-predictions may reflect diminishing returns from strong delivery metrics that do not immediately translate into engagement. From a management standpoint the model functions as an early-warning instrument: a decline in sprint completion or in communication quality predicts a corresponding decline in engagement one sprint ahead, allowing prompt remedial action before dissatisfaction becomes visible in surveys.

Applied significance for Kazakhstan: reuse of the NIT dataset and SIEM toolkit

The applied value of the study for Kazakhstan follows from where and how the data were collected. NIT is not an ordinary IT company but the single operator through which digital projects of practically all central and local state bodies pass, from the e-government portal and eGov Mobile to departmental information systems [27, 29]. Its project teams, coordination structures, and legal constraints (public procurement, budget cycles, information security requirements, approval by the authorized body) are the same constraints that any state body or quasi-public organization faces when delivering a digital project. The empirical base assembled in the course of the study – two waves of a structured survey (80 respondents each), 30 semi-structured interviews, four quarters of pre-implementation task reports, and twelve sprints of Jira metrics – is therefore, to the authors' knowledge, the first systematic dataset on stakeholder interaction in an Agile-transformed public IT organization in Kazakhstan, and it was collected in the organization whose practices are most likely to be transferred to others.

Three components of the study can be reused directly in similar projects. First, the baseline and post-implementation values reported in tables 3–5 (resolution rate 68% versus 90%, cycle time 9.6 days versus 1.8–3.0 days, positive engagement ratings 45% versus 76%) can serve as reference points for other state bodies: a project office that measures a resolution rate below 70% or a share of positive engagement ratings below 50% is in the pre-transformation zone documented at NIT, and the twelve-sprint trajectory in table 4 gives a realistic expectation of the pace of improvement. Second, the measurement instruments – the five-dimension survey, the interview guide structured around the same dimensions, the Jira metric set, and the target values by stakeholder layer in Table 8 – form a ready toolkit that does not require additional software and can be embedded in the reporting of project offices and in the monitoring of digitalization initiatives under the Concept for 2023–2029 [28]. Third, equation (4) can be used as an early-warning calculator: since sprint velocity and resolution rate are extracted automatically from Jira, the predicted engagement score can be recalculated after every sprint without repeating the survey, and a fall of the forecast below the 70-point threshold observed for the least engaged NIT respondents signals the need for a corrective retrospective. Table 11 summarizes the main scenarios of reuse.

Table 11 – Scenarios of reuse of the NIT dataset and SIEM instruments in Kazakhstan's public digital projects

Application scenario	Component reused	Who applies it	Expected effect
Other NIT projects (e-government platform services, departmental systems)	Full SIEM cycle; equation (4) recalibrated on new sprints	NIT project office, Scrum Masters, product owners	Continuous engagement monitoring across the project portfolio; earlier detection of coordination failures
Digital projects of central and local state bodies	Survey and interview instruments; reference values of Tables 3–5; target values of Table 8	Project offices of state bodies; digitalization units	Comparable engagement metrics across bodies; objective basis for reporting on digitalization initiatives
Projects of quasi-public IT operators and state holdings	Three-layer stakeholder architecture; stage-gate checkpoints for the outer layer	Corporate PMOs; boards of directors	Alignment of Agile teams with corporate governance and shareholder oversight
Monitoring by the authorized body for digitalization	Aggregated engagement indicators as part of project dashboards	Authorized body; grant AP26102429 project team	Portfolio-level transparency and accountability of digital projects; evidence base for policy adjustment
Training and certification of public project managers	Case data of NIT as a teaching case; SIEM as a methodological module	Universities, the Academy of Public Administration, PMI Kazakhstan Chapter	Standardized competence in stakeholder engagement for hybrid public projects
Note: Developed by the authors.			

Two conditions of transfer should be observed. The regression coefficients in table 9 reflect the scale of story points and the sprint length adopted at NIT, so in another organization the equation should be recalibrated on the first six to eight sprints before its forecasts are used for decisions, while the structure of the model and the set of predictors can be retained. In addition, the target values of Table 8 for the outer layer (for example, approval within five working days) depend on the procedural rules of the particular state body and should be agreed with its management at the Input Diagnosis stage. Within these conditions the NIT dataset and the SIEM toolkit provide Kazakhstan's public sector with an empirically grounded starting point for the evaluation of stakeholder interaction, which until now has been absent from the project management practice of state bodies.

Discussion and limitations

The results support the SIEM framework and highlight the value of the hybrid stakeholder engagement strategy. Combining Scrum's iterative feedback mechanisms with formal governance checkpoints allowed executive and regulatory stakeholders to be included in the project, and structuring stakeholders into inner, middle, and outer layers allowed targeted strategies for each group, filling the gaps left by one-size-fits-all engagement strategies. The findings show that a customized hybrid model can significantly improve stakeholder engagement without compromising essential oversight, even in highly regulated environments, and that adding a predictive analytics component enhances the usefulness of the framework. This is consistent with international evidence that hybrid approaches are not a poor second choice [8] and that Agile in government succeeds where it is adapted to institutional accountability requirements rather than imported unchanged [20, 22, 23].

Several limitations must be considered when interpreting the results. First, the research was carried out as a single-case analysis within one public-sector IT company; NIT has a distinct organizational culture, legal framework, and project characteristics, and what worked here might need modification elsewhere. Second, the number of stakeholders surveyed (80) and interviewed (15), although sufficient for a preliminary analysis, is modest and may limit statistical power, and some indicators – such as the conservative 3.0-day cycle time estimate – are proxies for better measurements. Third, the hybrid model was implemented over a fixed period without a control group, so other concurrent organizational changes may have contributed to the improvements, and causality should be asserted with caution. These limitations temper the conclusions but do not negate the consistent positive trends observed across independent data sources.

Conclusion

This study developed and empirically validated the Stakeholder Interaction Evaluation Model, a three-layer, four-stage framework for measuring and improving stakeholder engagement in public-sector IT projects that combine Agile practices with traditional governance. In the case of JSC “National Information Technologies”, the hybrid Agile-SIEM model raised the average share of positive engagement ratings from 45% to 76%, increased the task resolution rate from 68% to 90%, and cut task cycle time by at least two-thirds, while a regression model with five predictors explained 87% of the variation in engagement effectiveness. Communication quality, resolution rate, and sprint velocity emerged as the significant drivers of engagement, whereas role clarity and feedback responsiveness act as enabling conditions.

The applied result of the study for Kazakhstan is an empirical dataset and a measurement toolkit collected at the national e-government operator. Because NIT implements digital projects for all state bodies, the reference values, instruments, and the calibrated forecasting equation obtained here can be transferred to similar projects of state bodies, quasi-public IT operators, and the authorized body for digitalization, providing a common basis for evaluating stakeholder interaction in the implementation of the Concept of Digital Transformation for 2023–2029 and the Development Plan of NIT for 2024–2033.

Three recommendations follow for decision-makers and practitioners. First, stakeholder engagement metrics – role clarity index, alignment score, feedback responsiveness rate – should be formally incorporated into project governance dashboards and regular status reports of state bodies alongside standard KPIs, so that communication breakdowns are identified early and engagement is visible at executive level. Second, the three-layer SIEM framework should be applied and adapted to

other transformation projects, including non-IT process reforms and policy implementation projects, to ensure a unified, context-aware engagement strategy across the organization. Third, iterative feedback mechanisms such as sprint reviews and retrospectives should be extended beyond the core Agile team to cross-departmental workshops and end-user demonstrations at every stage of the project lifecycle.

Future research should apply SIEM in a variety of organizational contexts inside and outside Kazakhstan to test its generalizability, extend the set of engagement indicators and analytical methods (including machine-learning prediction), and conduct longitudinal studies of whether engagement gains translate into long-term project success, citizen satisfaction, and organizational agility.

Funding information. The article was prepared as a part of Grant project AP26102429 “Improving accountability and transparency in planning and implementing digital projects in public administration based on the application of project management in the Republic of Kazakhstan” funded by the Science and Higher Education Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan.

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МЕМЛЕКЕТТІК СЕКТОРДЫҢ ІТ-ОРТАСЫНДА AGILE-ТРАНСФОРМАЦИЯ КЕЗІНДЕГІ МҮДДЕЛІ ТАРАПТАРДЫҢ ӨЗАРА ІС-ҚИМЫЛЫН БАҒАЛАУ МОДЕЛІ

Аңдатпа

Бұл мақала мемлекеттік сектордағы ІТ-ұйымда Agile-трансформация барысында мүдделі тараптардың өзара әрекеттесуін бағалау және жетілдіру мақсатында Stakeholder Interaction Evaluation Model (SIEM) моделін әзірлеуге және валидациялауға арналған. Эмпирикалық зерттеу нысаны ретінде Қазақстанның электрондық үкімет инфрақұрылымының ұлттық операторы болып табылатын «Ұлттық ақпараттық технологиялар» АҚ (ҰАТ) қарастырылды. Мемлекеттік сектордың құқықтық және рәсімдік талаптарына сәйкестікті қамтамасыз ету үшін зерттеуде Agile әдіснамаларын дәстүрлі жоспарлауға негізделген тәсілдермен үйлестіретін контекстке бейімделген гибриді жобалық басқару моделі ұсынылады. Аралас әдістерге негізделген зерттеу екі кезеңнен тұратын деректер жинау үдерісін қамтыды: енгізуге дейінгі бастапқы кезеңде сауалнамалар, мүдделі тараптармен сұхбаттар және құжаттамалық талдау жүргізілді, ал енгізуден кейінгі кезеңде жаңартылған сауалнамалар, Jira жүйесінің процестік метрикалары және ретроспективалық талдау қолданылды. Операциялық жақындық пен стратегиялық ықпал деңгейлеріндегі айырмашылықтарды ескеру мақсатында мүдделі тараптар үш деңгейге бөлінді. Зерттеу сапалық талдаумен қатар, мүдделі тараптардың қатысуына байланысты деректерге предиктивті аналитика әдістерін қолданады. Спринттердің сәтті аяқталу деңгейі, кері байланыстың жеделдігі және коммуникация сапасы сияқты көрсеткіштер негізінде мүдделі тараптардың қатысу тиімділігін болжауға арналған көптік сызықтық регрессия моделі ұсынылған. Талдау нәтижелері гибриді тәсілдің жобаларды іске асыру тұрақтылығын, рөлдердің анықтығын және коммуникация тиімділігін арттырғанын көрсетті. Сонымен қатар, предиктивті модель кері байланыстың кешігуі немесе спринттердің аяқталу деңгейінің төмендеуі сияқты қатысу белсенділігінің әлсіреуінің ерте белгілерін анықтап, мүдделі тараптармен өзара әрекеттесу стратегиясын уақтылы бейімдеуге мүмкіндік береді. Зерттеудің Қазақстан үшін қолданбалы маңызы: деректер жиынтығы, сауалнама мен сұхбат құралдары, Jira метрикаларының жиынтығы және калибренген регрессиялық модель барлық мемлекеттік органдар үшін электрондық үкімет жобаларын іске асыратын оператор – «ҰАТ» АҚ-та жиналды, сондықтан олар мемлекеттік органдар мен квазимемлекеттік ІТ-операторлардың ұқсас цифрлық жобаларында эталондық мәндер және мониторинг құралдары ретінде қайта пайдаланылуы мүмкін. Қатаң реттелетін ІТ-орталарында зерттеу мүдделі тараптар динамикасын басқарудың тиімді әрі икемді құрылымын ұсынып, мемлекеттік сектордағы цифрлық трансформация жобаларын тиімді іске асыруға ықпал етеді.

Тірек сөздер: мүдделі тараптардың қатысуы, гибриді жобалық басқару, цифрлық трансформация, мемлекеттік сектор, ашықтық, есеп берушілік, электрондық үкімет.

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МОДЕЛЬ ОЦЕНКИ ВЗАИМОДЕЙСТВИЯ ЗАИНТЕРЕСОВАННЫХ СТОРОН В ПРОЦЕССЕ AGILE-ТРАНСФОРМАЦИИ В ИТ-СРЕДЕ ГОСУДАРСТВЕННОГО СЕКТОРА

Аннотация

В данной статье разрабатывается и валидируется модель оценки взаимодействия со стейкхолдерами (Stakeholder Interaction Evaluation Model – SIEM) с целью оценки и повышения эффективности взаимодействия заинтересованных сторон в процессе Agile-трансформации в ИТ-организации государственного сектора. В качестве эмпирического кейса рассматривается АО «Национальные информационные технологии» (НИТ) – национальный оператор инфраструктуры электронного правительства Казахстана. Для соответствия правовым и процедурным требованиям государственного сектора в исследовании предлагается контекстно-ориентированная гибридная модель управления проектами, объединяющая Agile-методологии с традиционными планово-ориентированными компонентами. Исследование основано на смешанном методологическом подходе и включает двухэтапный процесс сбора данных: базовый этап до внедрения, включающий опросы, интервью со стейкхолдерами и анализ документов, а также этап после внедрения, включающий модифицированные опросы, процессные метрики Jira и ретроспективный анализ. Для учета различий в степени операционной вовлеченности и стратегического влияния группы заинтересованных сторон были разделены на три уровня. Помимо качественного анализа, исследование применяет методы предиктивной аналитики к данным, связанным с вовлеченностью стейкхолдеров. В работе представлена модель множественной линейной регрессии для прогнозирования эффективности взаимодействия заинтересованных сторон на основе таких показателей, как успешность спринтов, скорость обратной связи и качество коммуникации. Результаты анализа показывают, что гибридный подход способствовал повышению стабильности реализации проектов, ясности распределения ролей и эффективности коммуникации. Предиктивная модель также выявляет ранние признаки снижения вовлеченности, такие как задержка обратной связи или снижение уровня завершения спринтов, что позволяет своевременно адаптировать стратегию взаимодействия со стейкхолдерами. Прикладное значение исследования для Казахстана состоит в том, что массив данных, инструменты опроса и интервью, набор метрик Jira и калиброванная регрессионная модель были собраны в АО «НИТ» – операторе, реализующем проекты электронного правительства для всех государственных органов, – и могут быть повторно использованы в качестве эталонных значений и инструментария мониторинга в аналогичных цифровых проектах государственных органов и квазигосударственных ИТ-операторов. В условиях высокорегулируемой ИТ-среды исследование предлагает практическую и адаптивную модель управления взаимодействием заинтересованных сторон, содействующую успешной цифровой трансформации государственного сектора.

Ключевые слова: вовлеченность заинтересованных сторон, гибридное проектное управление, цифровая трансформация, государственный сектор, прозрачность, подотчетность, электронное правительство.

Article submission date: 01.07.2026