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Transforming Fragmented Tourist-Visit Reporting into Integrated Tourism Monitoring: The Qinanti Dashboard and Business Process Redesign

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Abstract

Delayed and fragmented tourist-visit data weaken government responses to traffic congestion, overtourism, illegal levies, uneven visitor flows, and declining service quality. Dependence on late and inconsistent records also increases the risk of resource misallocation and may reduce destination competitiveness and investor confidence. This study redesigns the tourist-visit data collection process in West Java, Indonesia. A sequential explanatory design combined secondary records, interviews, observation, and document analysis. Recognize–Scrutinize–Materialize (RSM) approach was aligned with the Define–Measure–Analyze–Design–Verify (DMADV) framework to link user needs, root causes, and system design. The as-is business process required 435 minutes of processing and 9,645 minutes of waiting, producing a seven-day lead time and an active-time ratio of 4.32%. A 21-feature Requirement Feature Matrix and a role-based use-case model translated the redesign into implementable functions and actor responsibilities. The proposed process introduces single-entry recording, preventive validation, staged review, visible reporting status, automatic recapitulation, audit trails, controlled interoperability, analytical dashboards, and geospatial monitoring. Under a conservative simulation with one correction cycle, projected lead time declined to 504 minutes or 8 hours 24 minutes. Black-box testing confirmed the expected behaviour of all 19 implemented functions; anomaly detection and visit-trend prediction were excluded because they were classified as Won't Have. Heuristic interviews identified five areas for refinement. The findings demonstrate traceability from user needs and quality targets to role allocation, process design, and functional verification, although the simulated gains require post-implementation measurement.

Introduction

Timely and credible visitor statistics are essential for destination management because tourism demand may change rapidly during weekends, holiday periods, major events, and sudden issues in the field. When reporting is delayed, public agencies have limited capacity to recognise emerging pressure, redistribute visitor flows, or coordinate responses to congestion, overtourism, illegal levies, and declining service quality. This concern is relevant in West Java, where destinations such as Lembang, Pangandaran, and Puncak periodically experience concentrated visitor volumes. Evidence from Pangandaran shows that weekend arrivals can exceed the local population and contribute to crowding and environmental discomfort (Wahyuni et al., 2022). Current and comparable data are therefore needed to support proportionate operational responses and longer-term destination policy (United Nations World Tourism Organization, 2018; Liu & Dijk, 2022). The existing tourist-visit reporting process at the West Java Department of Tourism and Culture involves destination operators, accommodation providers, district or municipal administrators, and the provincial authority. Data are commonly recorded at the source, reorganised in spreadsheets, transferred through

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administrative levels, consolidated again, and checked near the end of the reporting chain (Zdybicki, 2025; Bonthu, 2025; Schön, 2023). Different formats and submission times make the information difficult to compare, while corrections require reports to move back to lower levels (Bustin et al., 2025; Jiang et al., 2023). As a result, the same record may be entered or processed more than once, and provincial monitoring becomes dependent on the completion of several manual stages.

Business Process Management provides an appropriate perspective for this problem because the performance of an information system depends on the coordination of activities, roles, information, controls, and technology (Bitkowska et al., 2023; Al Wahid et al., 2024; Zhang et al., 2023). Digitalisation can improve efficiency, but automation alone may reproduce an inefficient workflow in electronic form when the underlying process is not first examined and redesigned (Ahmad & Van Looy, 2020; Langmann & Turi, 2022; Szalavetz, 2023). A credible solution must therefore identify where waiting, repeated work, inconsistent data, and late decisions occur before translating those findings into system functions. Process modelling and performance measurement make that relationship visible and support structured comparison between the current and proposed arrangements (Compagnucci et al., 2024; Teixeira et al., 2024; Alhabeeb & Al-Shargabi, 2024; Mardanshahi et al., 2025; Abreu et al., 2023).

Design for Six Sigma contributes a quality-oriented structure for developing a new process. Its DMADV sequence - Define, Measure, Analyze, Design, and Verify - converts user expectations into measurable criteria, examines causes of performance gaps, and tests whether the proposed design satisfies those criteria. This approach is especially relevant when an organisation needs a substantially different process rather than a minor adjustment to an existing one (Baptista et al., 2020; Hanoosh & Kowang, 2023; Yang et al., 2022). However, DMADV does not by itself prescribe a concise way to explore user experience, work context, and early solution ideas in a digital public service.

RSM - Recognize, Scrutinize, and Materialize - supplies that user-oriented progression. Recognize develops an understanding of actors, needs, and pain points; Scrutinize examines the problem and formulates a value proposition; and Materialize converts the evidence into a tangible solution that can be reviewed and refined (Kouptsov & Srai, 2023; Bargoni et al., 2024). Previous applications show that RSM can support digital-platform design through user analysis, scenario development, prototyping, and iterative evaluation (Lubis et al., 2021a, 2021b, 2022). Its flexibility is useful for keeping the design close to daily work, although stronger measurement and verification controls are required when the research also aims to demonstrate process-quality improvement.

Earlier studies generally employ user-centred design and quality-oriented process design as separate methodological streams (Woodward et al., 2024). This separation leaves a practical gap: user statements may inform a prototype, yet the link from those statements to baseline measures, quality targets, process decisions, and verification results is not always explicit. The gap is important in public-sector information systems because an attractive interface may still preserve fragmented responsibilities, repeated data handling, and weak controls. This study addresses that issue by using RSM and DMADV in aligned domains while retaining their different methodological roles. The contribution lies in the traceable redesign of the reporting process and in the Qinanti dashboard capabilities that operationalise the redesigned flow.

Accordingly, the study addresses three questions: (1) which critical factors constrain the current tourist-visit data process; (2) how can RSM and DMADV be aligned to guide a measurable and user-oriented redesign; and (3) how can the resulting requirements be implemented and verified in Qinanti? The study contributes an as-is diagnosis, a source-oriented to-be process,

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projected performance estimates, and a functionally tested prototype that combines integrated reporting, analytical monitoring, and spatial interpretation. The simulation results are treated as design projections rather than realised organisational outcomes.

Methods

Research Design and Context

The research adopted a sequential explanatory design in which quantitative process evidence was examined first, and qualitative evidence was then used to explain the observed performance gaps (Creswell & Plano Clark, 2018). The unit of analysis was the tourist-visit data process rather than tourist behaviour. The study was conducted at the West Java Department of Tourism and Culture and followed reporting from destinations and accommodation providers through district or municipal administration to the provincial level. Quantitative analysis focused on processing time, waiting time, repeated input, data errors, platform fragmentation, and update delay. Qualitative analysis examined actor responsibilities, operational constraints, correction practices, information needs, and expectations of the redesigned system.

Primary evidence was collected through observation and semi-structured interviews with users representing destination operators, district or municipal administrators, and provincial administrators. Secondary evidence included official recapitulations, process documents, reporting guidance, system documentation, and the thesis design artefacts. Interview questions explored the current activity sequence, hand-offs, delays, repeated work, validation problems, and desired system behaviour. The analysis organised evidence by actor, activity, obstacle, consequence, and requirement. Findings were triangulated across interviews, observation, documents, BPMN models, time records, and prototype results so that later design decisions could be traced to more than one source.

RSM-DMADV Alignment and Analytical Procedure

The alignment was based on functional correspondence rather than the mechanical combination of two complete methods. RSM structured the movement from contextual understanding to a materialised solution, whereas DMADV supplied explicit quality measures, causal analysis, design controls, and verification logic. Table 1 summarises the three integrated stages, the purpose of each stage, the principal activities performed, and the outputs carried forward to the next stage.

Table 1. Operational alignment of RSM and DMADV

Integrated stage	Purpose	Main activities	Outputs
Recognize-Define	Establish the problem, scope, actors, and user expectations	Actor mapping; Voice of Customer; as-is BPMN; user persona and empathy analysis; initial CTQ definition	Problem scope; documented needs; baseline indicators; user requirements
Scrutinize-Measure-Analyze	Explain process performance gaps and their underlying causes	Problem scenario; time measurement; VSM; gap analysis; fishbone analysis; requirement prioritisation; value proposition	Waste categories; root causes; prioritised requirements; traceability logic

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Materialize-Design-Verify	Translate evidence into a process and system design that can be tested	To-be BPMN; Bizagi simulation; role and component design; database structure; prototype; black-box and heuristic evaluation	Qinanti process design; projected performance; verified functions; revision recommendations

Table 1 shows that the alignment preserves a continuous evidence chain: Recognize-Define establishes the problem and user expectations; Scrutinize-Measure-Analyze explains the performance gaps and their causes; and Materialize-Design-Verify converts the findings into a testable process and system design. Figure 1 presents the same relationship as a conceptual flow, emphasising how evidence and verification feedback move between the stages.

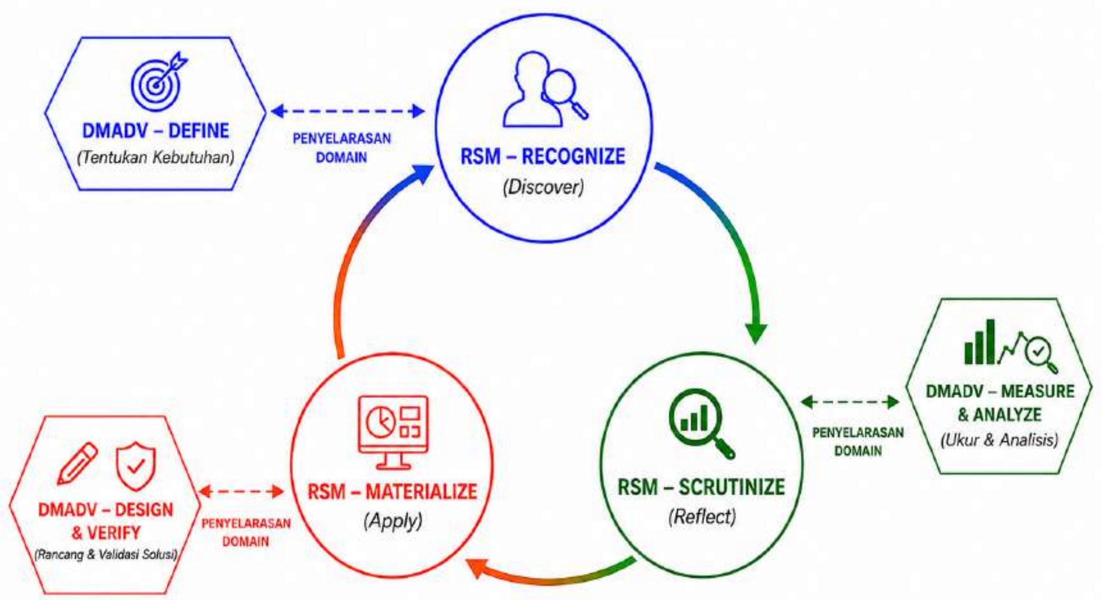

Figure 1. Conceptual alignment of RSM and DMADV in the Qinanti study

As illustrated in Figure 1, RSM remains the user-centred organising approach, while DMADV strengthens each stage with measurement and quality assurance. The circular relationship does not imply the creation of a new method; it represents iterative review. A proposed feature may return to an earlier stage when verification reveals that it does not sufficiently answer a user need, process gap, or Critical-to-Quality requirement.

Process Measurement, Redesign, and Verification

The as-is and to-be processes were modelled using BPMN 2.0 to represent activities, responsibilities, decision points, and data movement in a consistent notation (Compagnucci et al., 2024; Farshidi et al., 2024). Value Stream Mapping then separated processing time from waiting time and classified activities as value added, necessary non-value added, non-value added, or rework. Processing time referred to periods when an actor or the system actively handled the data, while waiting time referred to periods when the record remained idle before the next activity. Total lead time was calculated as the sum of processing and waiting time across the complete reporting sequence.

Broad user expectations were translated into five Critical-to-Quality dimensions: data-delivery time, number of input activities, error rate, number of operating platforms, and update delay. Baseline values were derived from process records, interviews, observation, and reporting

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documents, consistent with the need for explicit performance measures in process-improvement environments (Cunha et al., 2023; Menano de Carvalho et al., 2026). Design targets were used to evaluate whether a proposed capability addressed the identified gap; they were not treated as achieved performance before implementation. Root causes were organised into people, method, system or technology, data, and organisational categories. The resulting requirements were prioritised through MoSCoW to distinguish essential functions from features that could be deferred. Simulation was performed with Bizagi Modeler Simulation View. The as-is and to-be models used the same reporting starting point, unit of time, and one correction cycle so that their results could be compared on an equivalent basis. The as-is parameters represented spreadsheet preparation, file transfer, manual checking, correction, consolidation, and provincial recapitulation. The to-be parameters represented single-entry capture in Qinanti, automatic format and completeness checks, staged approval, final verification, automatic recapitulation, and dashboard updating. Because Qinanti had not yet been deployed across all reporting units, the to-be values were interpreted as a conservative projection.

Functional verification applied black-box scenarios to 19 implemented features. For each feature, the test compared the user action, the observed system response, and the expected output without examining source code. Visit-anomaly detection and visit-trend predictions were excluded because the Requirement Feature Matrix classified them as Won't Have and they were not implemented in the prototype. The same matrix informed a use-case model that allocated functions to destination operators, district or municipal administrators, and provincial administrators. Interface evaluation was subsequently conducted through interviews structured around Nielsen's ten usability heuristics (Nielsen, 1994), allowing functional correctness and interaction quality to be assessed as distinct dimensions.

Results and Discussion

Current Process, Waste, and Critical-to-Quality Gaps

The as-is process consisted of nine main activities distributed across destination operators, district or municipal administrators, and provincial administrators. Operators first collected and recorded visitor data, then reorganised the same information in a spreadsheet and sent the file to the district or municipal level. Administrators checked completeness and consistency, returned unsuitable data for correction, combined accepted records, and forwarded a regional recapitulation to the province. Provincial administrators then received, rechecked, recapitulated, and published the data. Validation occurred after several hand-offs, so even a limited error could initiate another correction and transmission cycle.

Figure 2 visualises the complete as-is sequence and places each activity in the lane of the responsible actor. The diagram is particularly useful for locating three forms of process waste: repeated data handling at the source, manual consolidation at the district or municipal level, and delayed quality control after the file has already moved through the reporting chain.

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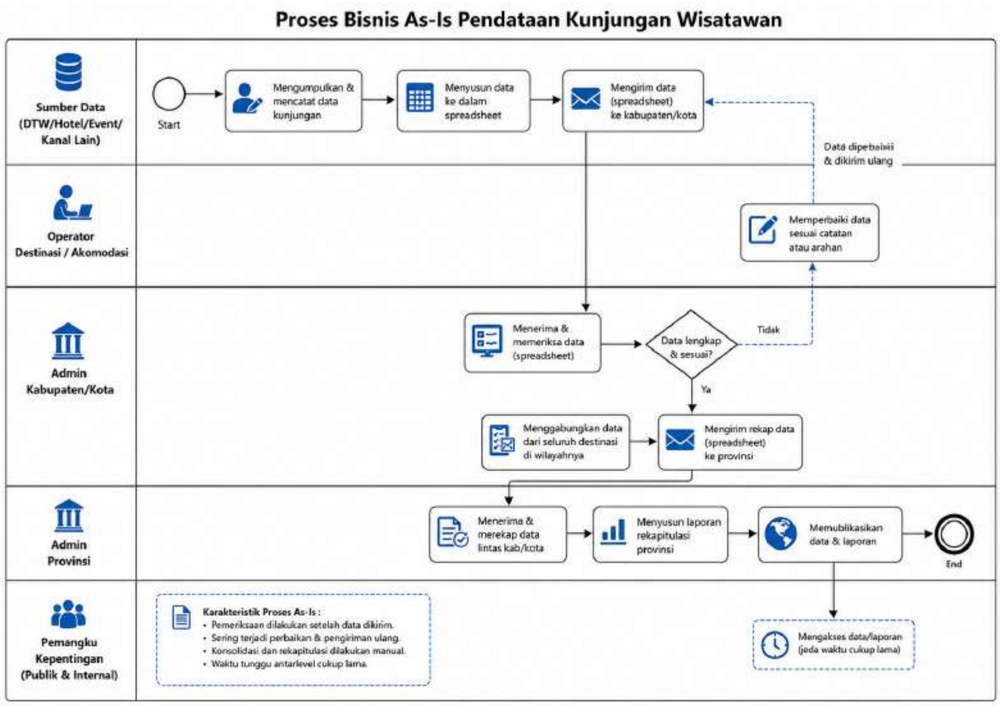

Figure 2. As-is BPMN model of tourist-visit data collection

Figure 2 confirms that data quality is inspected only after records have moved across administrative boundaries. The correction loop therefore repeats both communication and waiting, while manual consolidation separates data collection from timely monitoring. These weaknesses were converted into measurable baseline-target gaps, as summarised in Table 2.

Table 2. Baseline process performance and design targets

CTQ dimension	Baseline	Design target	Implication for the redesign
Data-delivery time	7 days	≤ 1 day	Remove at least six days from the reporting and information cycle.
Input efficiency	2 entries or recapitulations	1 source entry	Reuse one record for review, aggregation, monitoring, and reporting.
Data accuracy	8% error rate	≤ 2%	Use standard fields, required-field controls, and preventive validation.
System integration	≥ 2 operating platforms	One principal integrated flow	Apply common data structures and controlled exchange between sources.
Update delay	7 days	< 1 day	Update monitoring views directly after approval and verification.

Table 2 indicates that the most substantial gaps concern time and data reuse. A seven-day delivery and update cycle cannot support near-current monitoring, while two input or recapitulation activities create avoidable opportunities for transcription error. The accuracy and integration targets also show that the redesign must address data structure and workflow control, not only the appearance of the dashboard.

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Value Stream Mapping quantified the consequences of the process shown in Figure 2. Active processing required 435 minutes, whereas waiting between activities reached 9,645 minutes. Total lead time was therefore 10,080 minutes, equivalent to seven days. Only 4.32% of the cycle consisted of active work. The remaining time was dominated by waiting for submission, checking, correction, consolidation, and transfer between administrative levels. This distribution confirms that the principal inefficiency was not the duration of a single task, but the accumulation of queues and hand-offs across the reporting chain.

The baseline also explains why an isolated interface improvement would not be sufficient. A dashboard can display only the information that reaches the database; it cannot compensate for records that remain in spreadsheets, use inconsistent structures, or wait for consolidation. The redesign therefore had to move quality controls closer to the first point of capture, allow the same record to be reused across reporting purposes, and make the status of each record visible to every authorised level.

Root Causes and Methodological Traceability

Root-cause analysis identified interdependent factors rather than a single technological failure. People-related causes included uneven digital competence and reliance on manual inspection. Method-related causes included repeated entry, tiered recapitulation, and validation near the end of the process. System-related causes involved disconnected channels and limited status visibility. Data-related causes concerned non-standard formats and incomplete fields, while organisational causes reflected different submission times and coordination practices across administrative levels. Together, these factors produced delayed availability, correction loops, inconsistent aggregation, and limited use of the data for monitoring.

The analysis shifted the design objective from accelerating file delivery to controlling the data lifecycle from its source. Each major problem was translated into a requirement: repeated recording became a single-entry requirement; inconsistent formats became master-data and standard-field requirements; late error detection became preventive validation; unclear progress became status monitoring; and untraceable corrections became audit-log and history requirements. This translation provided a visible path from evidence to design and reduced the likelihood that features would be selected solely because they were technically attractive.

The aligned methods played different but complementary roles in this reasoning. RSM maintained attention to actors, pain points, value propositions, and iterative feedback, consistent with earlier digital-platform studies (Lubis et al., 2021a, 2021b, 2022). DMADV required the design team to express those needs as measurable CTQs, examine causes, compare alternatives, and verify the resulting process and prototype. The methodological value lies in traceability, while the substantive contribution lies in the redesigned process and the Qinanti capabilities that respond to the identified quality gaps.

To-Be Process and Projected Performance

The to-be process starts when a destination operator enters one standard visit record in Qinanti. The system immediately checks required fields, data types, reporting periods, and completeness before the record can proceed. After submission, the district or municipal administrator reviews the data through a shared dashboard and either returns the record with a correction note or approves it. The provincial administrator performs final verification, after which Qinanti generates recapitulations and updates the analytical dashboard automatically. This sequence removes spreadsheet preparation, manual file transfer, repeated consolidation, and separate provincial recapitulation while retaining the administrative responsibilities of each level.

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Figure 3 presents the redesigned sequence in BPMN form. The model distinguishes the work of the destination operator, the automated controls performed by Qinanti, the district or municipal review, and the provincial verification. It also shows that responsibility remains distributed even though the record is stored and reused in one integrated workflow.

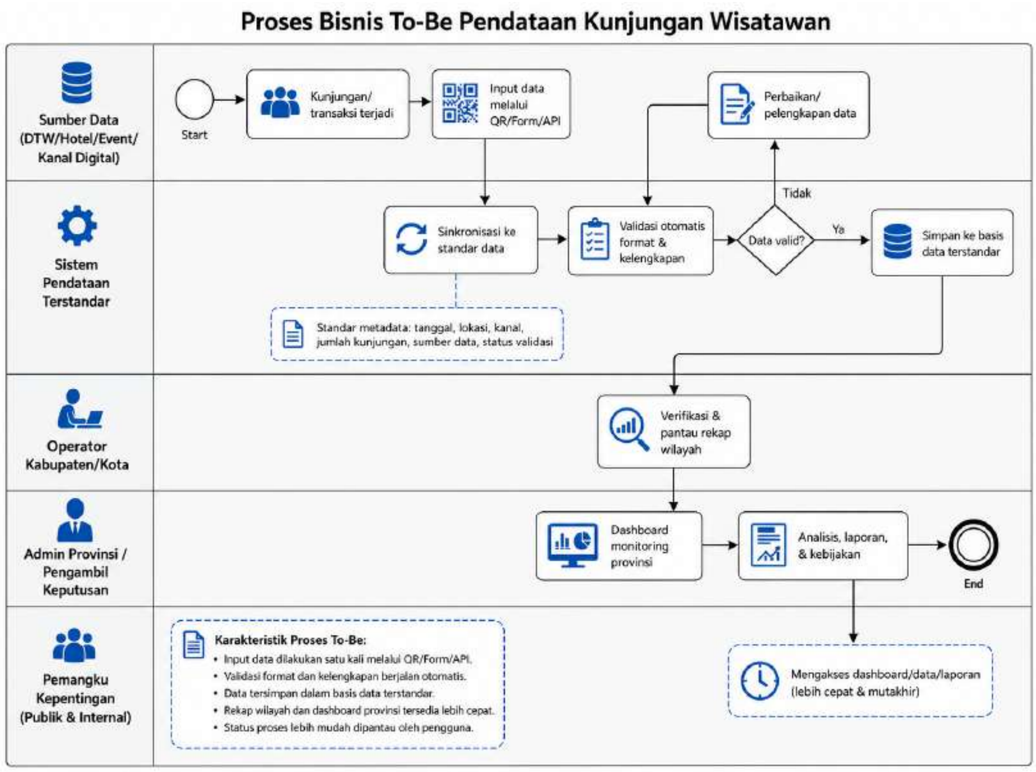

Figure. 3. To-be BPMN model for tourist-visit data collection through Qinanti

Figure 3 confirms that the redesign removes duplicate files without removing accountability. Operators remain responsible for data entry and correction, district or municipal administrators for regional review and approval, and provincial administrators for final verification and cross-regional monitoring. The projected effect of this change is quantified in Table 3.

Table 3. VSM and simulation comparison of the as-is and to-be processes

Indicator	**As-is condition**	**To-be projection**	**Projected change**
Processing time	435 min	84 min	-80.69%
Waiting time	9,645 min	420 min	-95.65%
Lead time	10,080 min (7 days)	504 min (8 h 24 min)	-95.00%
Active-time ratio	4.32%	16.67%	+12.35 percentage points
Input/recapitulation frequency	≥ 2 times	1 time	Repeated handling removed
Manual file transfer	3 transfers	0 transfers	Replaced by an integrated workflow
Data availability	H+7	Same day	Less than 1 day

Table 3 demonstrates that the redesign changes both the duration and the structure of the process. Repeated input and three file transfers are removed, the active-time ratio increases, and validated data become available on the same day. Figure 4 translates the principal time

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measures into a visual comparison so that the difference between active work and accumulated waiting can be read more directly.

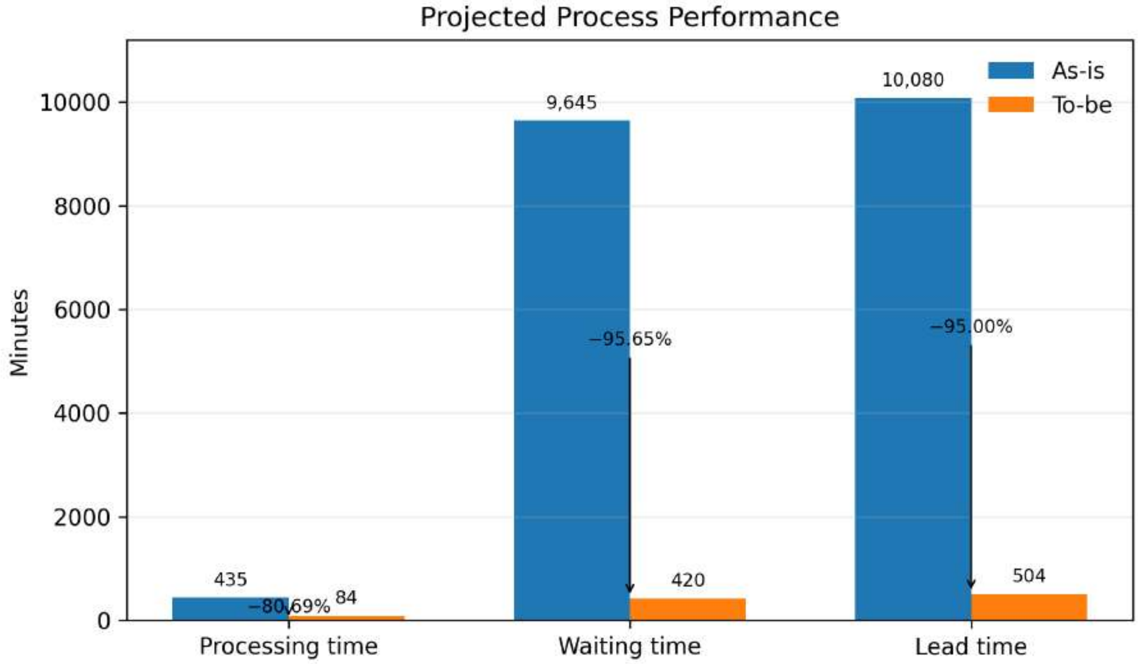

Figure 4. Projected comparison of processing, waiting, and lead time

Figure 4 shows that waiting time accounts for most of the projected improvement. In the conservative one-correction scenario, processing time declines from 435 to 84 minutes, while waiting time falls from 9,645 to 420 minutes. The resulting lead time is 504 minutes, or approximately 8 hours 24 minutes, compared with 10,080 minutes in the as-is process. This represents a projected reduction of 95.00% and raises the active-time ratio from 4.32% to 16.67%.

The reduction should be interpreted with care. It does not yet represent performance observed across all reporting units; it is the output of a simulation based on the VSM parameters and assumes that users follow the redesigned workflow, system services remain available, and one correction cycle is sufficient. Nevertheless, the result is analytically useful because it identifies the mechanisms expected to produce the improvement: removal of file transfer, elimination of repeated recapitulation, earlier validation, and automated updating after final verification.

Qinanti Artefact and Information Capabilities

The process decisions were decomposed into implementable system capabilities. Essential controls included authentication, role-based access, regional and destination master data, a single-entry visit form, completeness validation, staged verification, automatic recapitulation, multi-source integration, and an audit log. Supporting capabilities included search and filters, submission confirmation, report export, analytical dashboards, and geospatial monitoring. Table 4 groups the capabilities that most directly connect the redesigned workflow with the CTQ dimensions of timeliness, accuracy, integration, visibility, and auditability.

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Table 4. Core Qinanti capabilities and their process-quality contribution

Capability	Information or control provided	Contribution to process quality
Single-entry form and preventive validation	Standard period, location, source, visitor category, numeric fields, and completeness checks	Reduces repeated transcription and prevents incomplete records from moving downstream.
Staged verification and status monitoring	Draft, submitted, revision, approved, and verified states with timestamps and correction notes	Makes responsibility, progress, and required follow-up visible across administrative levels.
Automatic recapitulation and audit trail	Aggregation by region, destination, period, and source, supported by user and change history	Reduces manual calculation and strengthens accountability and traceability.
Controlled interoperability	Source identity, exchange structure, transmission status, processing time, and validation response	Allows data reuse across connected services without removing source ownership.
Analytical and geospatial monitoring	Comparisons, trends, reporting coverage, regional distribution, and digital maps	Shortens the path from validated records to managerial and spatial interpretation.

Table 4 shows that dashboard and spatial functions depend on controls operating earlier in the data lifecycle. Analytical outputs can be trusted only when records use common master data, pass preventive validation, retain their source, and preserve a traceable change history. The next stage therefore converts these capabilities into a prioritised requirement structure and assigns them to authorised actors.

Requirement Feature Matrix and Role Allocation

The Requirement Feature Matrix preserves traceability between process evidence, Critical-to-Quality targets, and implementable system functions. Table 5 organises 21 requirements into three development iterations and applies MoSCoW prioritisation so that prototype scope reflects process criticality rather than visual prominence. Iteration 1 establishes access control, master data, source-level data capture, and initial validation. Iteration 2 strengthens verification, monitoring, feedback, and auditability, while Iteration 3 provides recapitulation, analytics, reporting, multi-source integration, and geospatial interpretation.

Table 5. Requirement Feature Matrix for the Qinanti Information System

No.	Requirement	Linked users need or CTQ	MoSCoW
Iteration 1 - Foundational controls and core data capture			
1	Login	Secure and accountable access	Must Have
2	Role and access management	Authority control across administrative levels	Must Have
3	Role-based dashboard	Information and status matched to user responsibility	Must Have

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4	Regional master data	Consistent location reference and aggregation	Must Have
5	Destination master data	Traceable and standard reporting sources	Must Have
6	Tourist-visit form	Single entry and shorter delivery time	Must Have
7	Completeness validation	Lower error rate and preventive control	Must Have
8	Data interoperability	Reuse of records across connected systems	Should Have
9	Form-entry guidance	Lower learning effort and input error	Could Have
Iteration 2 - Validation, control, and reporting monitoring			
10	Verification feedback	Clear and traceable correction cycle	Could Have
11	Audit log	Accountability and change history	Should Have
12	Data verification	Staged quality control before final use	Must Have
13	Submission confirmation	Evidence of receipt and visible status	Should Have
14	Visit-data anomaly detection	Early identification of implausible values	Won't Have
15	Visit-data search and filters	Faster retrieval by period, region, and status	Should Have
Iteration 3 - Recapitulation, analytics, and strategic reporting			
16	Automatic recapitulation	Reduced manual work and calculation error	Must Have
17	Analytical visit dashboard	Comparable monitoring and policy information	Should Have
18	Automatic report export	Standard and reusable administrative output	Should Have
19	Visit-trend prediction	Forward-looking planning information	Won't Have
20	Multi-source data integration	One principal integrated information flow	Must Have
21	Geospatial visit mapping	Location-based monitoring and prioritisation	Should Have

The matrix contains 10 Must Have, 7 Should Have, 2 Could Have, and 2 Won't Have requirements. Authentication, master data, single-entry capture, completeness checks, verification, automatic recapitulation, and multi-source integration receive Must Have priority because they directly address the baseline gaps. Anomaly detection and visit-trend prediction are deferred until sufficiently complete historical data and validated analytical rules are available. This prioritisation defines both the prototype boundary and the scope of functional testing.

The matrix defines what Qinanti must provide, whereas the use-case model clarifies who may perform each function. Figure 5 allocates the core interactions among the destination operator, district or municipal administrator, and provincial administrator. The allocation follows role-

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based access principles so that all actors work with a shared data environment without receiving identical privileges.

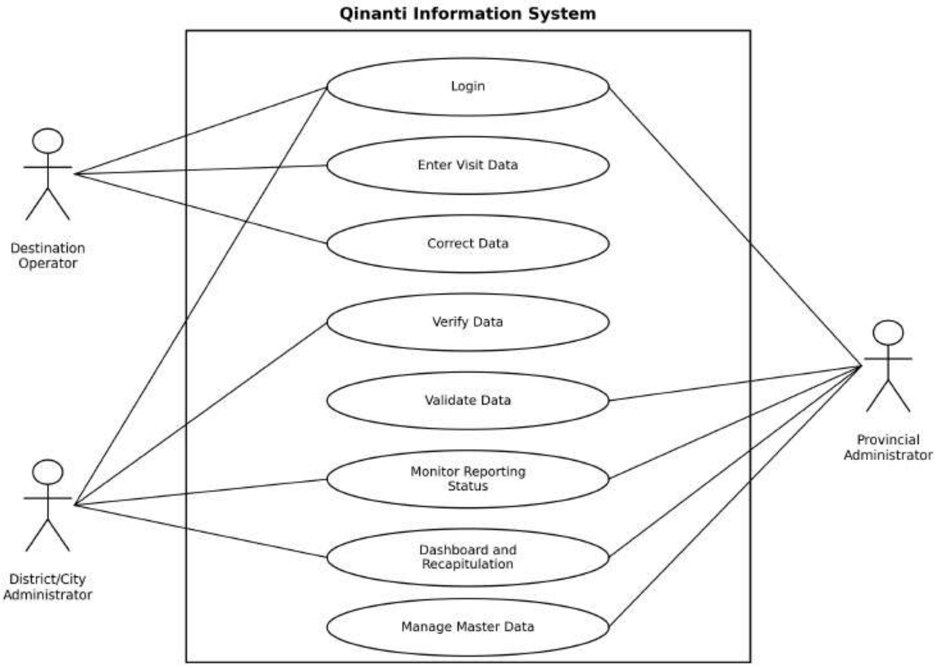

Figure 5. Use-case diagram of the Qinanti Information System

Figure 5 shows that destination operators record and correct visit data, district or municipal administrators verify submissions and monitor reporting progress, and provincial administrators validate cross-regional data, manage master data, and use provincial dashboards. Login and monitoring functions support a common workflow, while restricted functions preserve administrative accountability. These actor-function relationships provide the basis for access-control scenarios and the black-box tests reported later in the study.

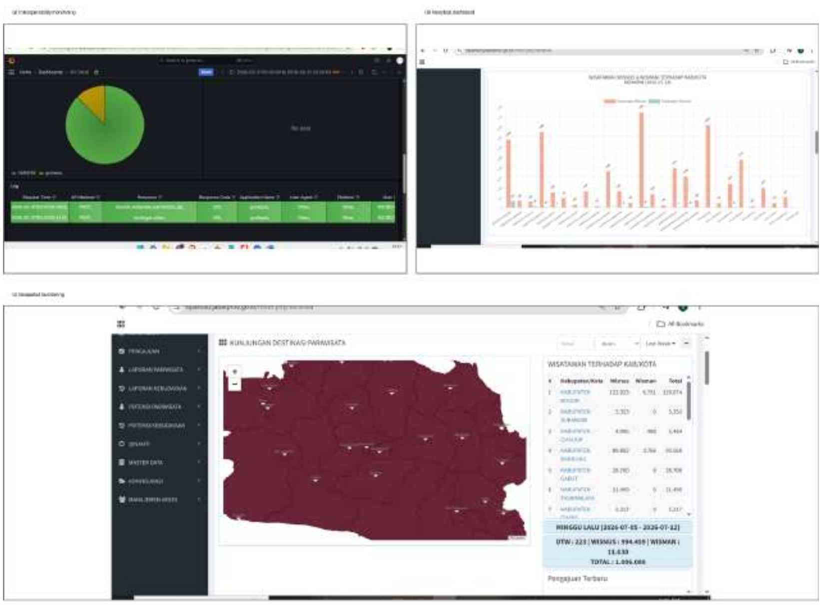

Figure 6. Core Qinanti interfaces: (a) interoperability monitoring, (b) analytical dashboard, and (c) geospatial monitoring

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The interfaces in Figure 6 are connected rather than independent screens. Interoperability monitoring records the source, exchange structure, transmission status, and validation response of connected data channels. This approach does not require every external service to be replaced; it establishes a principal data structure and governance point so that information can be reused without losing source ownership. Such controlled exchange addresses the integration gap more realistically than assuming that organisational fragmentation can be solved by a single application alone.

The analytical dashboard converts verified records into comparisons by period, region, destination, source, and visitor category. Geospatial monitoring adds a location-based perspective by showing visit distribution and reporting coverage across districts and municipalities. The map must be interpreted together with the number of reporting destinations and the status of the underlying data, because colour intensity may otherwise reflect differences in participation rather than actual demand. Together, these interfaces shorten the path from validated records to managerial interpretation while preserving the contextual information required for responsible policy use.

Functional and Usability Verification

Black-box testing evaluated 19 of the 21 prioritised requirements by comparing user actions, expected outputs, and observed system responses. The two Won't Have functions—visit-data anomaly detection and visit-trend prediction—were excluded because they were not implemented. Table 6 presents the tested functions and the prototype response recorded for each scenario.

Table 6. Black-box functional testing results

Tested feature	Verification focus	Observed system response	Status
Login	Valid, invalid, and incomplete credentials	Accepted valid accounts; rejected invalid or incomplete input	Passed
Role and access management	Menus, data, and actions by user role	Displayed functions according to operator, district/city, and provincial authority	Passed
Role-based dashboard	Dashboard content by user role	Displayed information and menus matched to each responsibility	Passed
Regional master data	Create, edit, search, and deactivate regions	Stored valid records and rejected incomplete or duplicate entries	Passed
Destination master data	Create and update destinations and reporting sources	Stored destinations and linked them to the correct region	Passed
Tourist-visit form	Period, location, source, visitor category, and totals	Accepted complete records and calculated total visits automatically	Passed
Completeness validation	Required fields and data-format checks	Rejected incomplete records and marked fields requiring correction	Passed

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Data interoperability	Exchange through standard structures and formats	Processed valid structures and rejected invalid formats	Passed
Form-entry guidance	Instructions and examples for input fields	Displayed contextual guidance for required information	Passed
Verification feedback	Creation and receipt of correction notes	Stored correction notes and displayed them on returned reports	Passed
Audit log	Input, change, submission, and verification activities	Recorded user, time, action type, and change history	Passed
Data verification	Review, approval, and return of reports	Updated status and allowed correction of returned reports	Passed
Submission confirmation	Evidence after successful report submission	Displayed confirmation, submitted status, and submission time	Passed
Visit-data search and filters	Period, region, destination, status, and source filters	Returned matching records and indicated when no data were found	Passed
Automatic recapitulation	Totals by region, period, source, and visitor category	Calculated domestic, international, and overall totals automatically	Passed
Analytical visit dashboard	Graphs, tables, trends, and regional comparison	Displayed analytics according to selected filters	Passed
Automatic report export	CSV export of filtered recapitulation	Generated a CSV file with matching structure and record count	Passed
Multi-source data integration	Destinations, accommodation, events, and other sources	Preserved source identity and prevented duplicate aggregation	Passed
Geospatial visit mapping	Location and regional visit distribution	Displayed destinations, visit totals, and regional information on the map	Passed

All 19 scenarios produced the expected response and were recorded as passed. The result demonstrates functional conformity at prototype level and confirms the traceability chain from the Requirement Feature Matrix to actor permissions and executable functions. It does not yet establish production reliability, security, performance, or the achievement of operational CTQ targets, which require separate post-implementation evaluation.

Heuristic Evaluation and Interface Revision

Heuristic interviews assessed how well the prototype supported everyday work. Users valued draft saving, correction of returned records, recognisable menus, automatic recapitulation, and a dashboard that was understandable without excessive visual density. Five recurring issues remained: reporting-status visibility, submission evidence, verification guidance, destination-

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capacity context, and advanced analytical efficiency. Table 7 links each issue to a specific revision.

Table 7. Heuristic findings and design recommendations

Code and heuristic principle	Evaluation finding	Recommended design response
F-01 Visibility of system status	Reporting deadlines, delays, and review progress were not sufficiently prominent.	Display deadline, last update, delay indicators, and clear draft, submitted, revision, and approved states.
F-02 Help users recognise, diagnose, and recover from errors	The system did not provide durable submission evidence for tracing and recovering a report.	Generate a reference-numbered receipt containing the reporter, destination, period, submission time, data summary, and acceptance status.
F-03 Help and documentation	Verification still depended heavily on administrator experience and informal communication.	Provide contextual definitions, completeness criteria, examples of errors and correction notes, and step-by-step verification guidance.
F-04 Match between system and the real world	Visit totals were not connected to destination carrying capacity or crowding conditions.	Combine visit totals with destination capacity and display normal, alert, warning, and critical levels for early overtourism monitoring.
F-05 Flexibility and efficiency of use	Historical trends, cross-region comparisons, and visit prediction still required processing in other applications.	Add historical trends, cross-period and cross-region comparisons, and later predictive analytics based on validated historical data.

Table 7 shows that the remaining issues concern workflow transparency and information support. Clearer status indicators, durable submission evidence, standard verification guidance, carrying-capacity alerts, and stronger comparative analytics form a focused revision agenda for the next Qinanti iteration.

The findings demonstrate the iterative function of RSM and the quality-control role of DMADV. Evaluation returned user evidence to the design process rather than assigning an absolute success or failure label. DMADV strengthened this iteration by requiring every revision and test scenario to be traced to a requirement, actor responsibility, and relevant CTQ. The matrix, use-case model, black-box results, and heuristic findings therefore form a coherent verification chain rather than separate design documents.

From a governance perspective, the design balances shared standards with distributed responsibility. Data remain entered and reviewed near their source, while structures, aggregation, and provincial monitoring are shared. Qinanti therefore coordinates data governance without creating a central-entry bottleneck or preserving disconnected local records.

Limitations

The study concerns one provincial reporting process and mainly domestic-visit data. The interviews do not represent every reporting unit, and the to-be times remain simulation outputs

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rather than full-scale operational measurements. Black-box testing was conducted on a functional prototype and did not assess security, concurrent load, long-term reliability, or production interoperability. The use-case model represents the principal roles and does not capture every exceptional administrative path. Interoperability also depends on institutional agreements, infrastructure, and external data quality. Future work should pilot Qinanti in selected regions and evaluate CTQ performance, task-level usability, access control, security, load, and cross-system exchange under operational conditions.

Conclusion

This study produced a source-oriented redesign of tourist-visit reporting and an integrated Qinanti dashboard through RSM-DMADV alignment. The seven-day as-is cycle was dominated by waiting, repeated input, spreadsheet consolidation, late validation, and file transfer. The to-be design replaces these constraints with single-entry recording, preventive validation, traceable verification, visible status, automatic recapitulation, audit history, interoperability, analytics, and geospatial monitoring. A 21-feature Requirement Feature Matrix established three implementation iterations and MoSCoW priorities, while the use-case model assigned the principal functions to destination operators, district or municipal administrators, and provincial administrators. Simulation projected lead time to decline from 10,080 to 504 minutes. Black-box testing confirmed the expected behaviour of all 19 implemented functions, and heuristic evaluation identified five targeted refinements concerning status visibility, submission evidence, verification guidance, carrying-capacity context, and analytical efficiency. The findings demonstrate a traceable link from user evidence and CTQ measures to requirements, actor responsibilities, process decisions, system capabilities, and verification. Operational gains must still be confirmed after implementation, but the design provides a structured basis for faster, more consistent, and policy-relevant tourism monitoring.

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