

Evaluating the Impact of Converting to Agile on Small and Medium-Sized Enterprises (SMEs): Is It Always a Positive Move?

Kingsley Nnaemeka Nwaigbo



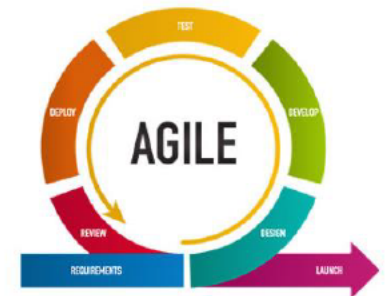
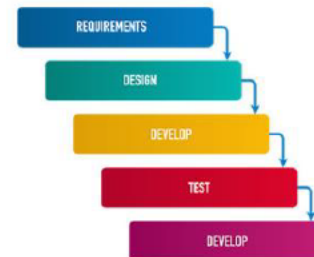
MBAR 661 (HBD-SUMMER25-02) : Academic Research Project

Dr. Khazraei, Ali

Introduction / Background/ Literature

- SMEs face increasing pressure to stay competitive, innovative, and responsive to customer needs.
- Traditional project management often fails to meet these demands; Agile offers flexibility, adaptability, and customer collaboration.
- Very few literature exists for Agile adoption in SMEs for Non-Software or non-IT industries. Hence, it was difficult to predict Agile adoption, across all industries.
- Existing research shows mixed outcomes.
- There is no evidence of any predictive model for successful Agile adoption across all industries.
- This research addresses the critical gaps above and answers the key research questions.
- Significance: Provides empirical evidence, industry-wide insights, and a Machine Learning-based framework (HITMEA) to guide SMEs in making informed Agile adoption decisions.

WATER FALL



Research Questions/ Hypothesis



Question 1: What is the effect of the adoption of Agile project management on SMEs? Is it always a positive move?



Question 2: What are the success factors and barriers that influence Agile performance across several industries?



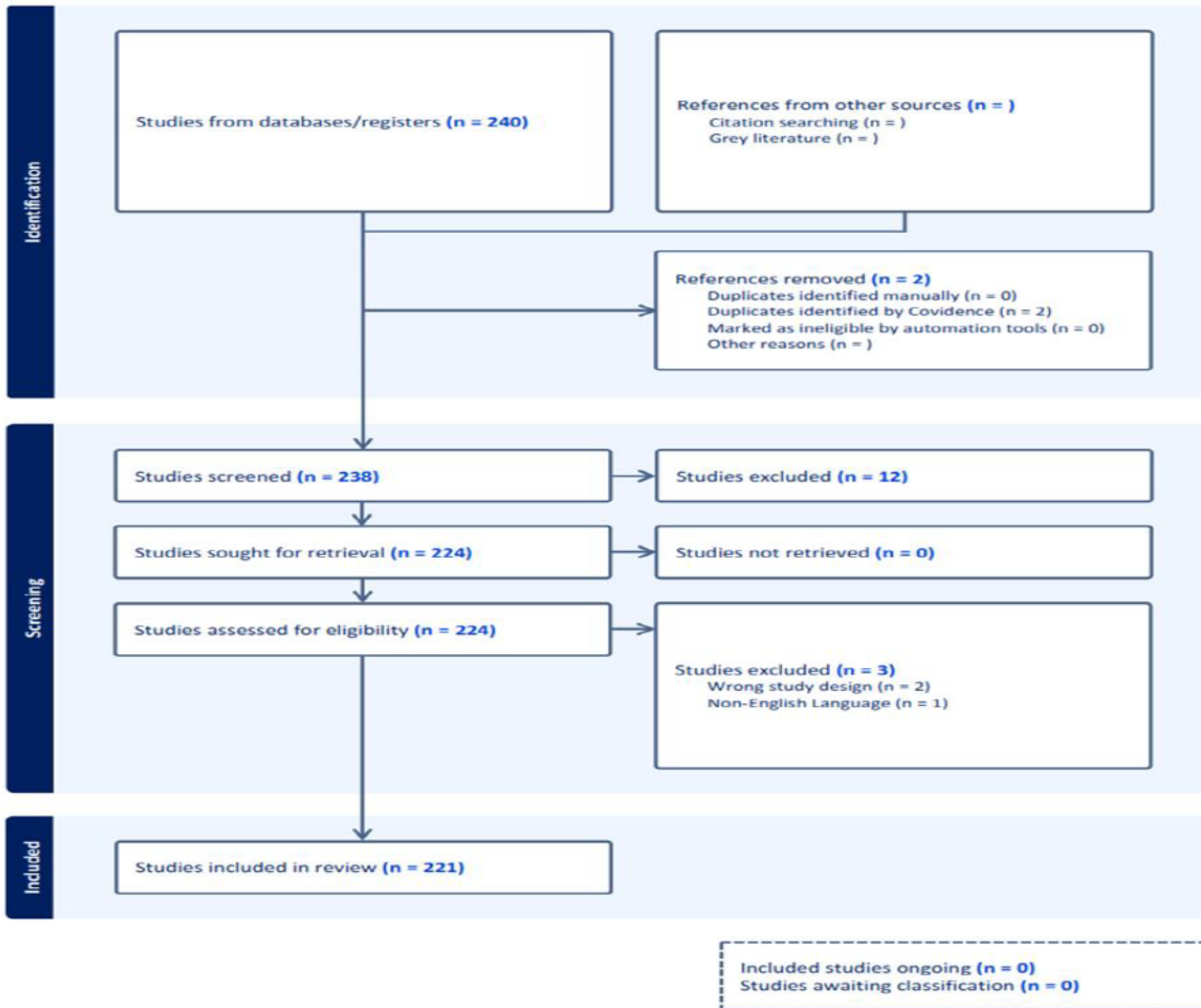
Question 3: What model can help SMEs appraise the success or failure of Agile implementation and potential Return on Investment?



Question 4: In terms of project outcomes on SMEs, what is the comparison between Agile and traditional project management approaches?

Prisma Report

Evaluating the Impact of Converting to Agile on Small and Medium-Sized Enterprises (SMEs): Is It Always a Positive Move?

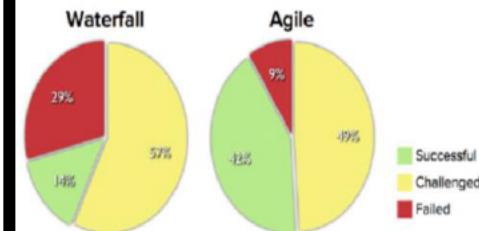
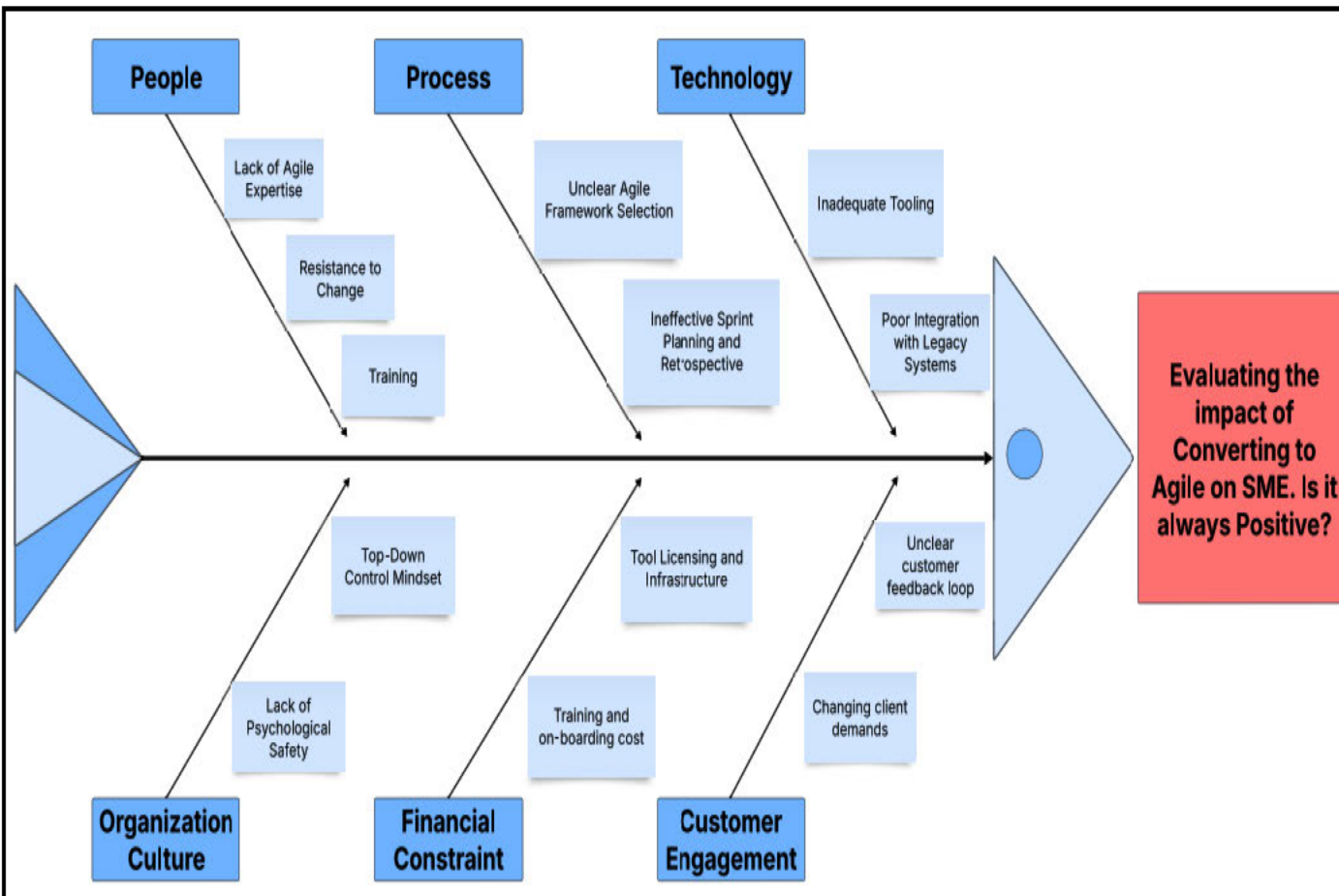


Root Cause of Agile Effectiveness

What: A disciplined diagnosis that traces Agile adoption problems to their underlying causes

Why: To stop treating symptoms (missed sprints, low quality, resistance) and target fixes that actually unlock Agile value and stick

How: Run a fishbone + 5 Whys workshop, cluster causes into the six buckets, then implement countermeasures with clear owners, timelines, **OKRs**, and review in each retrospective.



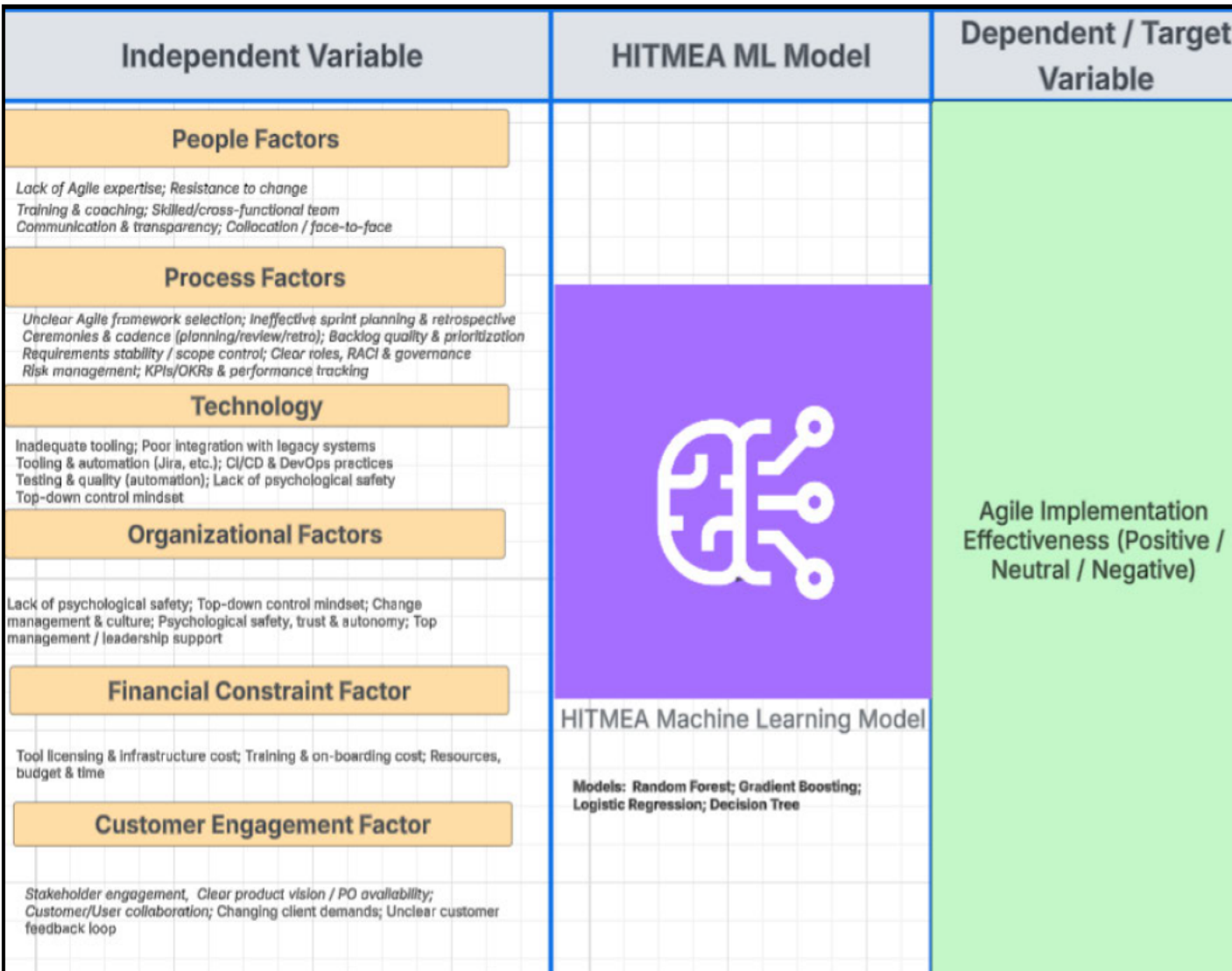
(Carilli, James F., 2013)

Conceptual Framework

What: It maps the key variables and their relationships, guiding the study's questions, measures, and analysis

Why: It provides more effective prediction capabilities

How: Leverages proven Machine learning principles for prediction of Target

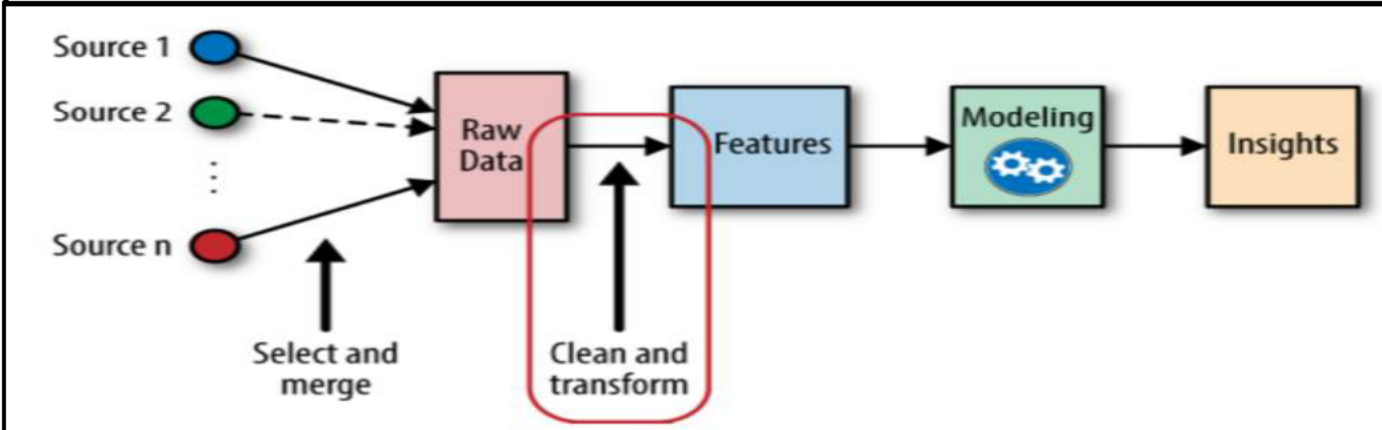
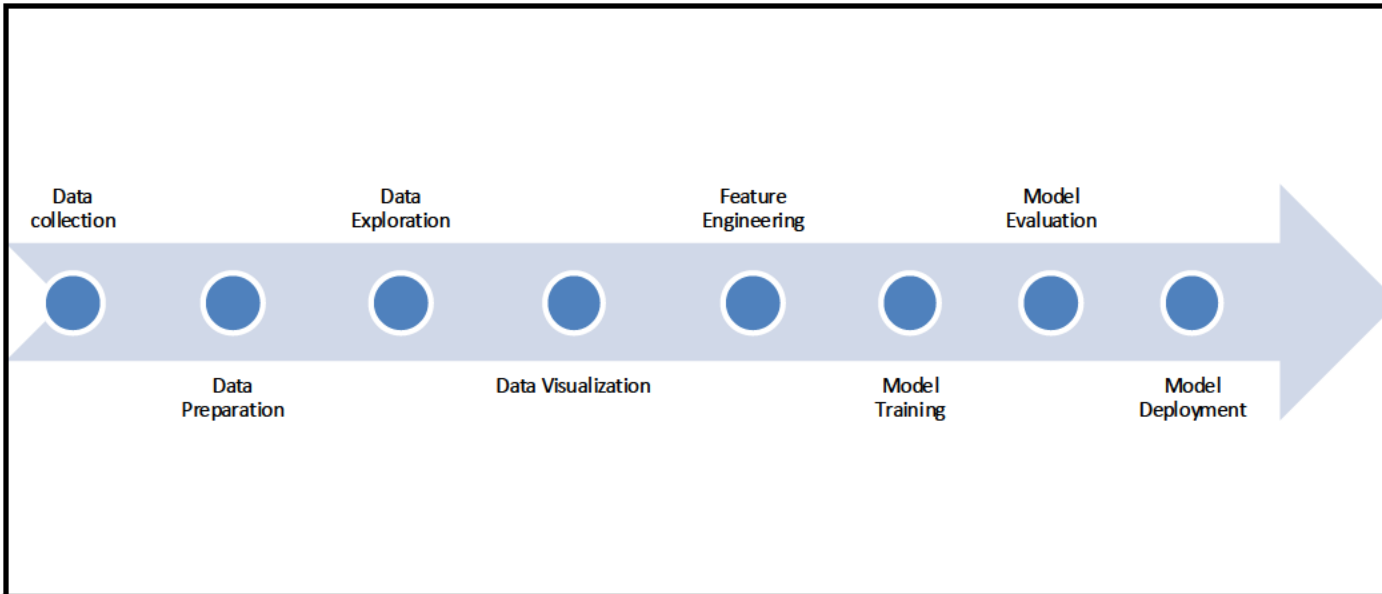


Methodology/ Data Analysis

What: Provides the structure for research project execution (Qualitative and Quantitative approach)

Why: Provides deep human-centered insights to the study

How: Used Literature review insights, and Quantitative analysis insights



Independent Variable	HITMEA ML Model	Dependent / Target Variable
People Factors Level of digital literacy, Resistance to change, Training & awareness, Skillset, Knowledge, Experience, Attitude, Motivation, etc.		Agile Implementation Effectiveness (Positive / Neutral / Negative)
Process Factors Technical skills, Process knowledge, Understanding of agile, Understanding of agile, Understanding of agile, Understanding of agile, etc.		
Technology Understanding of agile, Understanding of agile, Understanding of agile, Understanding of agile, etc.		
Organizational Factors Organizational culture, Organizational structure, Organizational processes, Organizational resources, etc.		
Financial Constraint Factor Budget, Cost, etc.	HITMEA Machine Learning Model Models: Random Forest, Gradient Boosting, Support Vector, etc.	
Customer Engagement Factor Customer engagement, Customer satisfaction, etc.		

Results: Qualitative Analysis

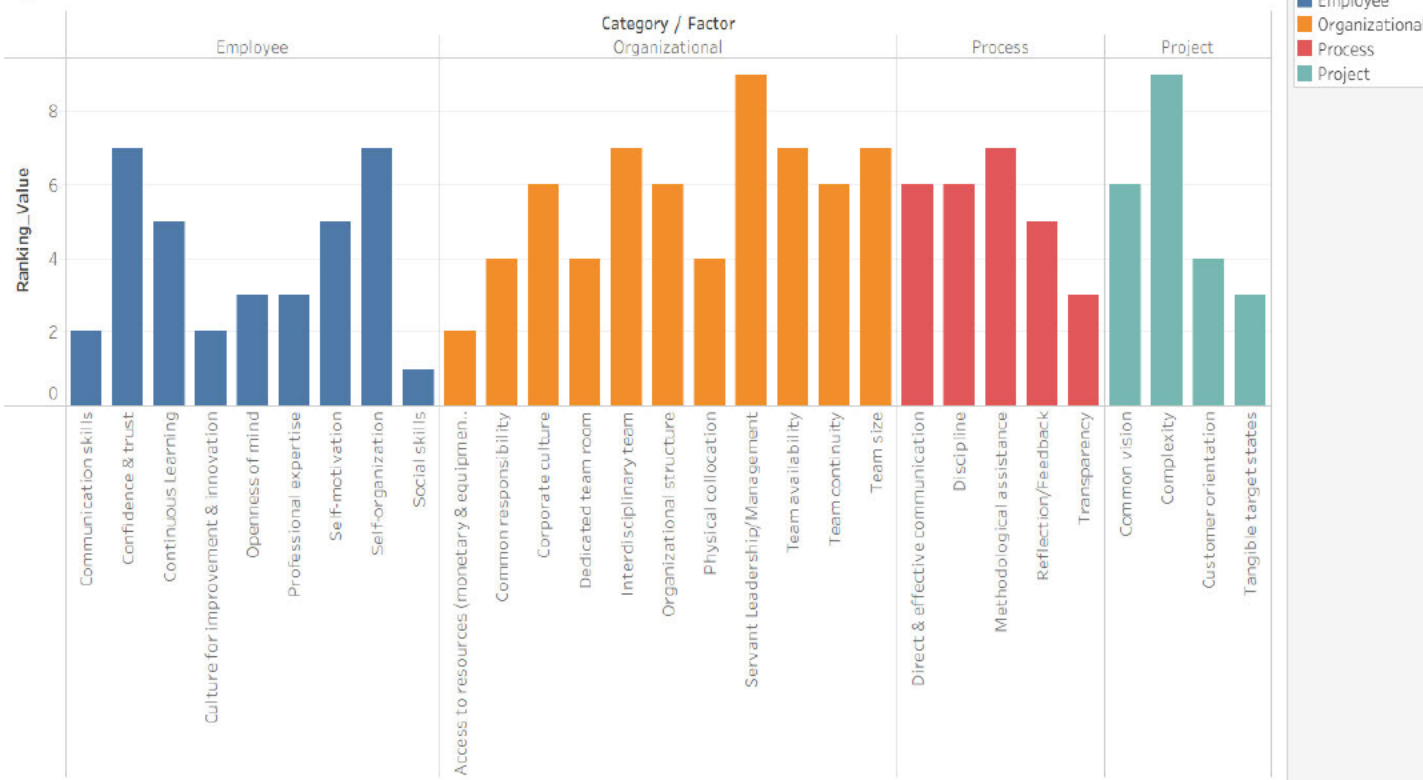
Employee: Confidence & trust, self-organizing/motivated teams, continuous learning, strong communication, and solid professional experience drive success.

Organizational: Servant leadership, right team size, interdisciplinary teams, high team availability/continuity, and a supportive corporate culture boost outcomes.

Process: Direct & effective communication, disciplined adherence to process, methodological support, and tight feedback loops (inspect-and-adapt) are critical.

Project: A well-understood common vision, customer orientation, and fit-for-complexity planning underpin successful Agile adoption.

Agile Success Factors



Results: Qualitative Analysis

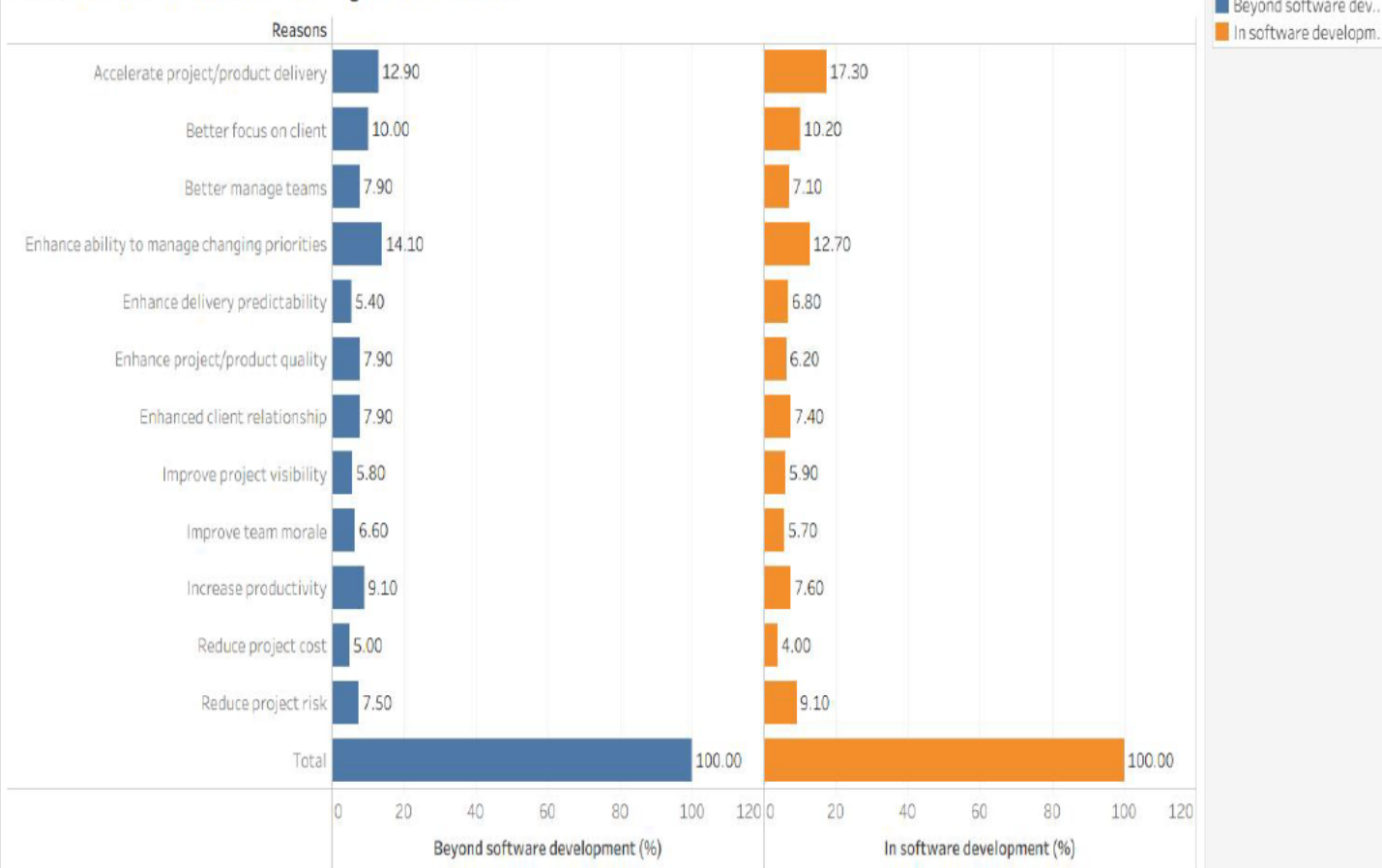
Common drivers (both groups): Accelerate delivery and better manage changing priorities are the top reasons to adopt Agile.

Software teams focus: Speed plus **risk reduction** and tighter **client focus** are emphasized.

Beyond software adds: Stronger emphasis on **productivity, quality, team management**, and **client relationships** alongside speed and priority management.

Secondary motives: Predictability, visibility, morale, and cost reduction matter, but rank below the primary drivers.

Reasons and Justification for Agile introduction



Results: Qualitative Analysis

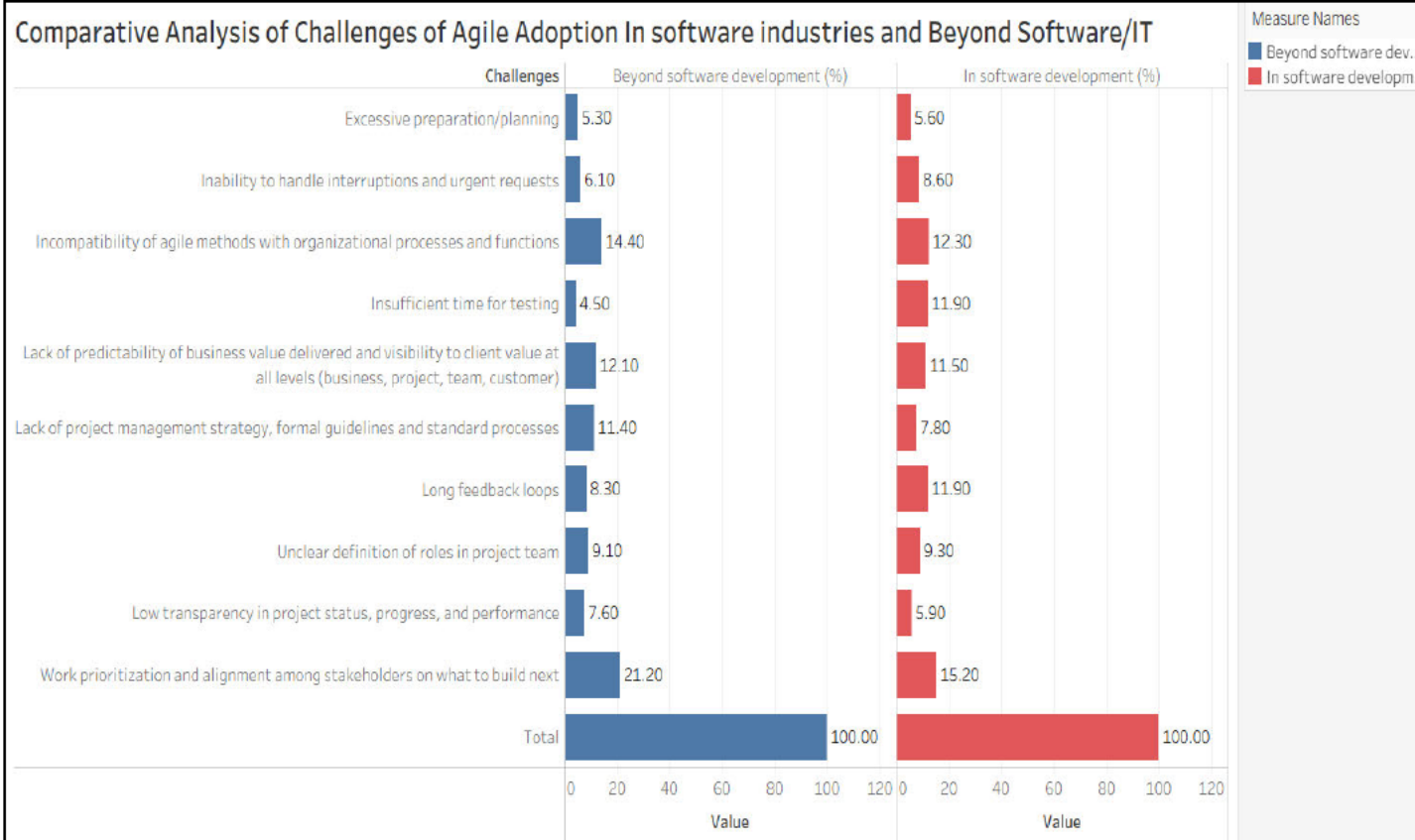
Top shared blocker: Prioritization & alignment on “what to build next” — teams need clear scope guardrails and a rigorous backlog/refinement cadence

Structural friction: Agile practices often clash with existing processes and functions; without operating-model changes, adoption stalls.

Predictability gap: Limited visibility of delivered business value (business/project/team/customer levels) erodes trust and momentum.

Sector nuance: Software teams feel **testing time** (and interruptions/long feedback loops) more acutely; these are less severe beyond software.

Comparative Analysis of Challenges of Agile Adoption In software industries and Beyond Software/IT



Results: Qualitative Analysis

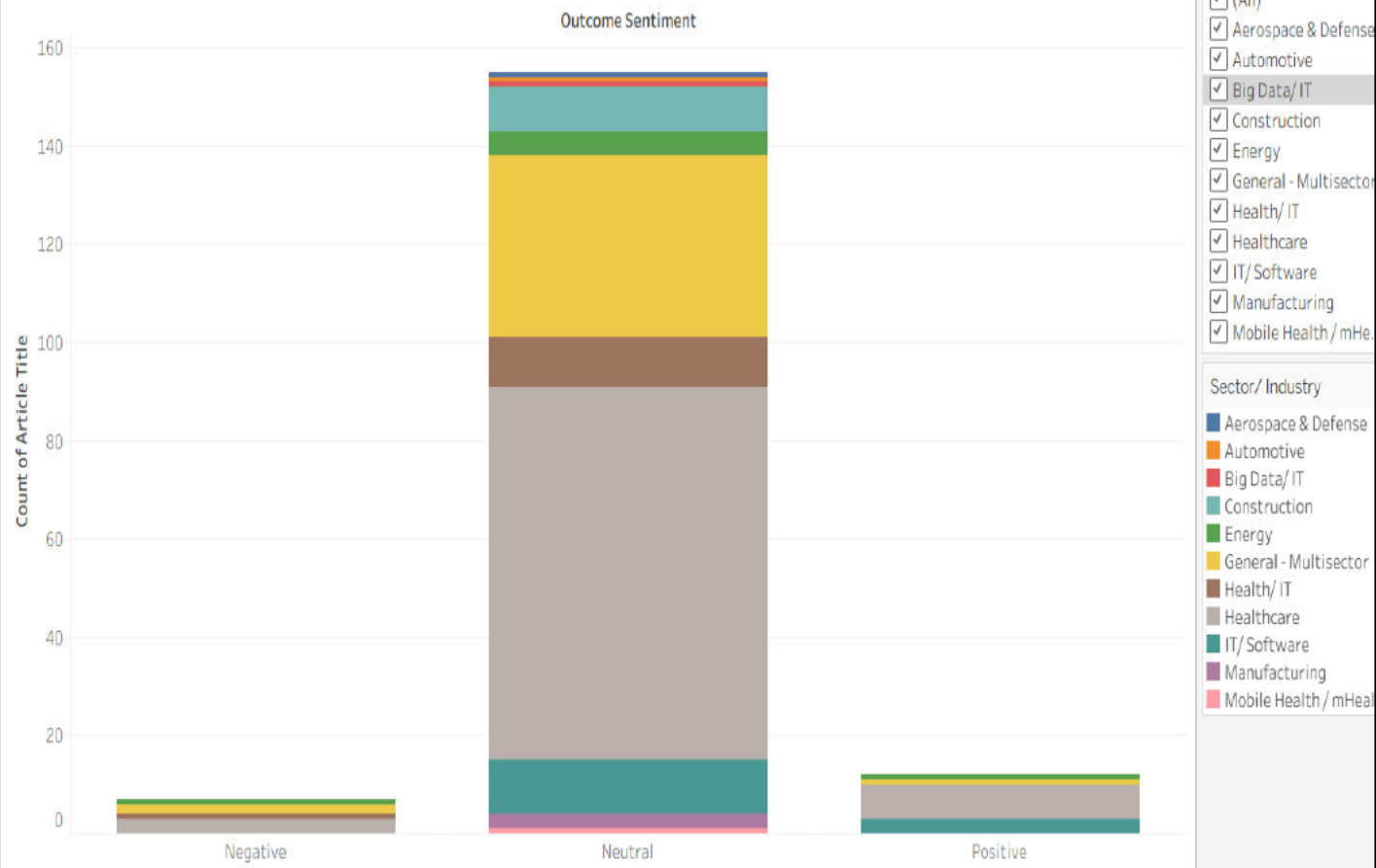
Adoption is broad: Evidence spans multiple sectors, confirming Agile use beyond software.

Adoption is broad: Evidence spans multiple sectors, confirming Agile use beyond software.

Key finding: Neutral sentiment dominates overall; positive and negative views are much smaller.

Sector signal: Neutral views are led by **mHealth, Manufacturing, Healthcare, IT/Software**, and **multi-sector** studies.

Sentiment of Agile Adoption Outcome 2



Results: Quantitative Analysis Ph1

What: **Confusion matrix** compares predictions vs. actuals using TP, TN, FP, FN to judge classifier performance.

Model accuracy: Logistic Regression **57.5%** (best) › Random Forest **52.5%** › Decision Tree **50%** › Gradient Boosting **45%**.

Logistic Regression details: TP=11, TN=12, FP=8, FN=9—near-balanced classes but many errors.

Implication: Performance is only slightly above chance; More dataset for training Model may improve prediction Accuracy.

Performance Metrics



Best Model

Logistic Regression

Accuracy: 0.575

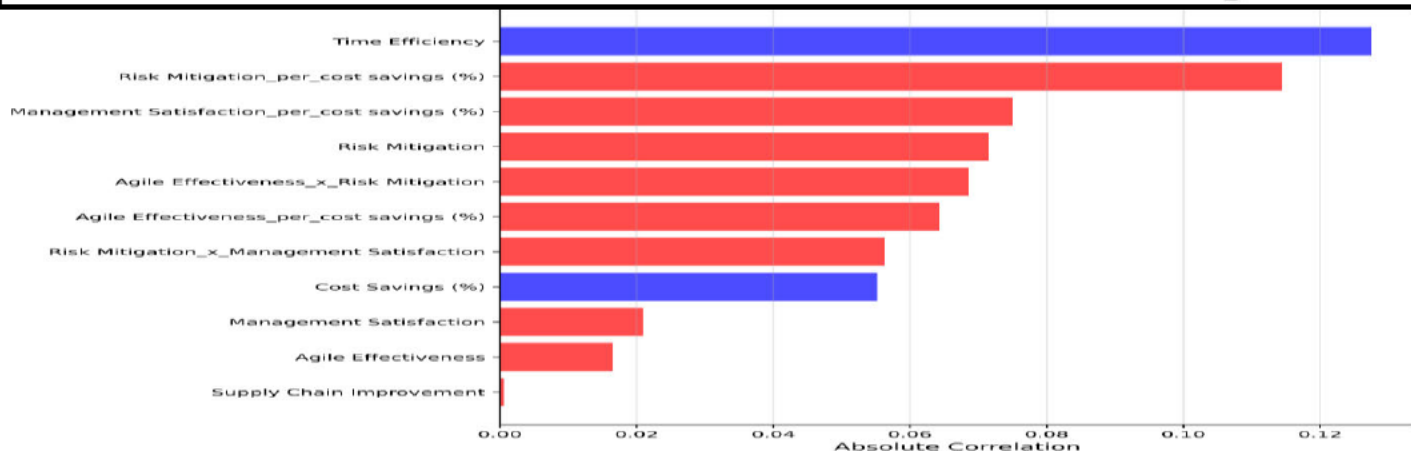
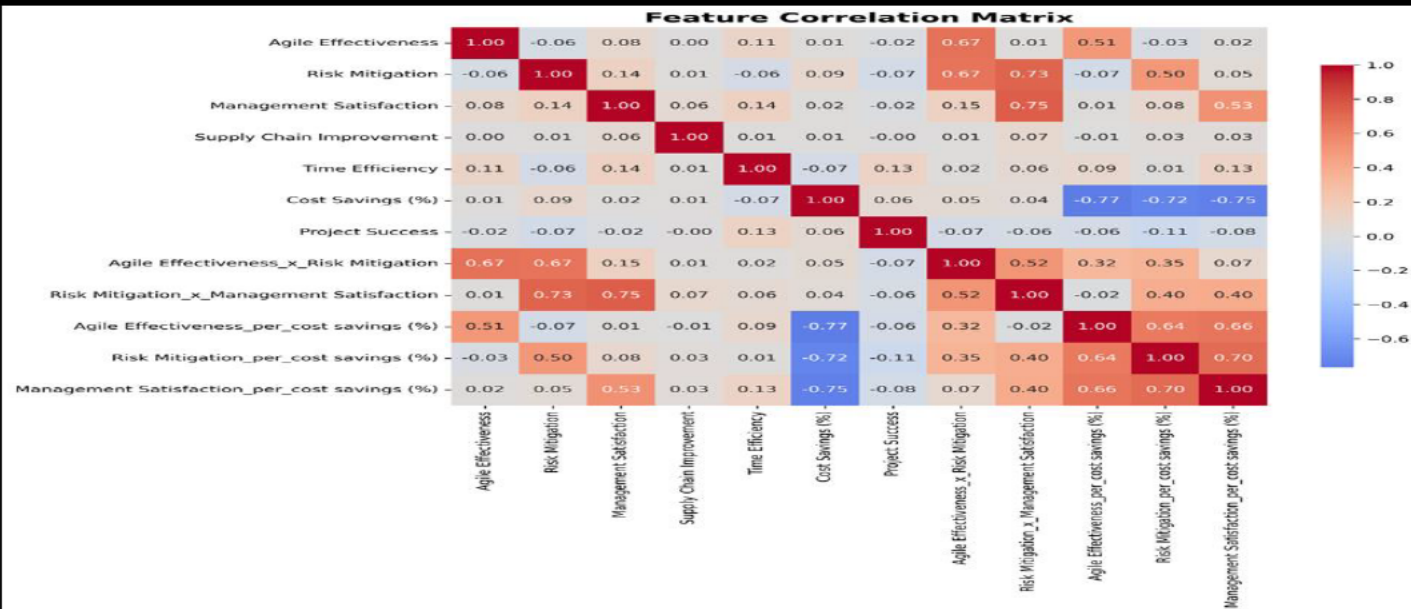
Model	Accuracy	Precision	Recall	F1_Score
Logistic Regression	0.575	0.5789	0.55	0.5641
Random Forest	0.525	0.5238	0.55	0.5366
Decision Tree	0.5	0.5	0.5	0.5
Gradient Boosting	0.45	0.4444	0.4	0.4211

Results: Quantitative Analysis Ph1

What: A correlation heatmap and a Feature Correlation ranked bar chart show how each factor relates to **Project Success**.

Why: To pinpoint the strongest drivers of Agile outcomes and focus both management action and feature selection.

How: Compute Pearson correlations and rank by absolute value—**Time Efficiency**, **Cost savings** and **Risk-Mitigation per cost** emerge as the top signals.



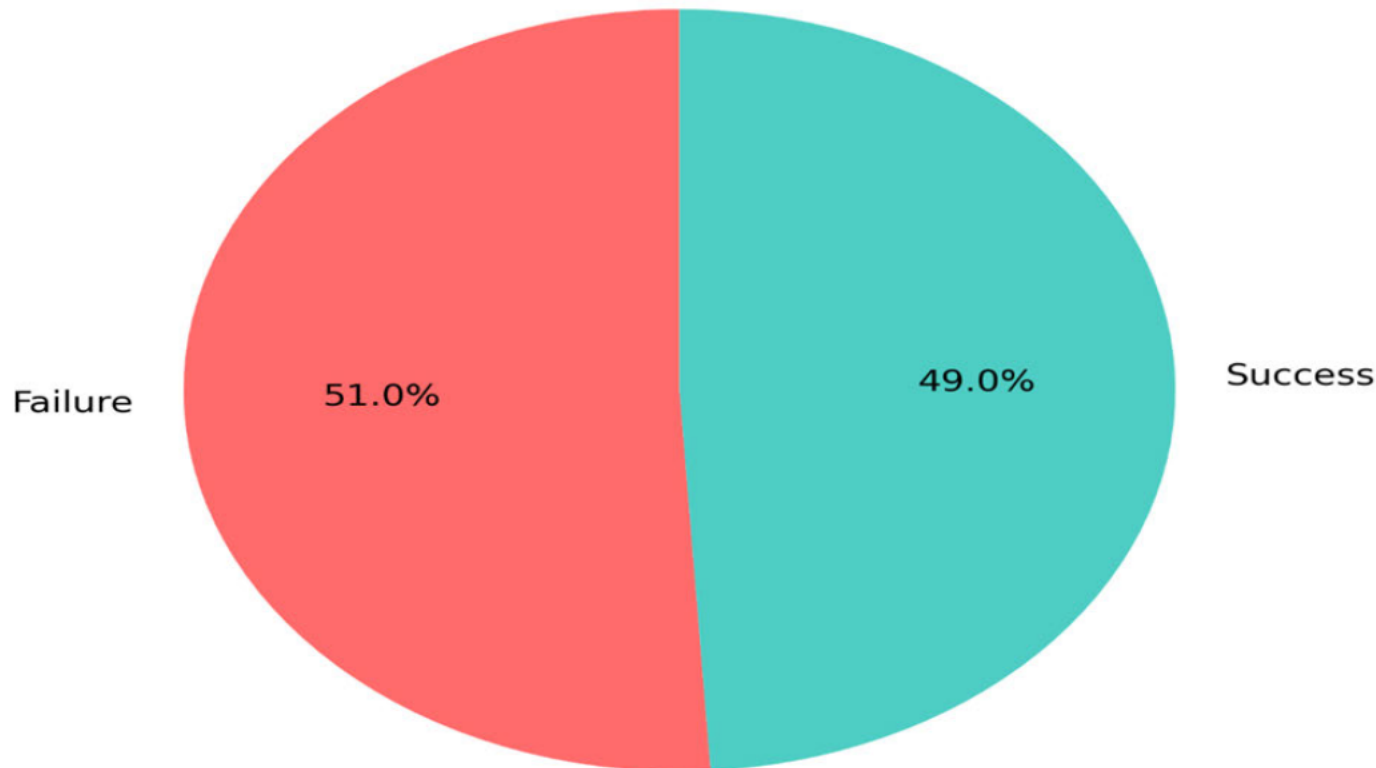
Results: Quantitative Analysis Ph1

What: Agile adoption alone doesn't guarantee success, because not all the success factors show a positive correlation.

Why: Trade-offs are inherent- Improving one area can strain other areas.

Example: Recovering a delayed schedule often requires extra resources or more cost

Project Success Distribution

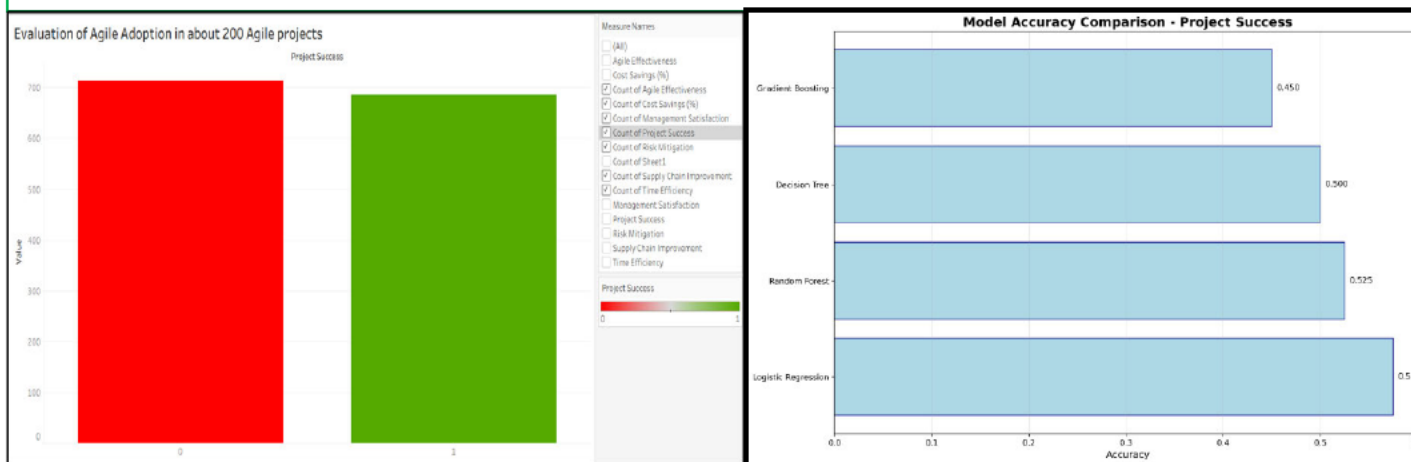


Results: Quantitative Analysis Ph1

What: The results from Part 1 Quantitative Analysis for Agile adoption effectiveness prediction

Why: Provided concrete numerical answers to the study questions

How: Used Kaggle datasets for model Model training and data analysis



Phase 1 Data Analysis _ Model Prediction Accuracy/

HITMEA Model	Accuracy	Precision	Recall	F1_Score
Logistic Regression	0.575	0.5789	0.55	0.5641
Random Forest	0.525	0.5238	0.55	0.5365
Decision Tree	0.5	0.5	0.5	0.5
Gradient Boosting	0.45	0.4444	0.4	0.4210

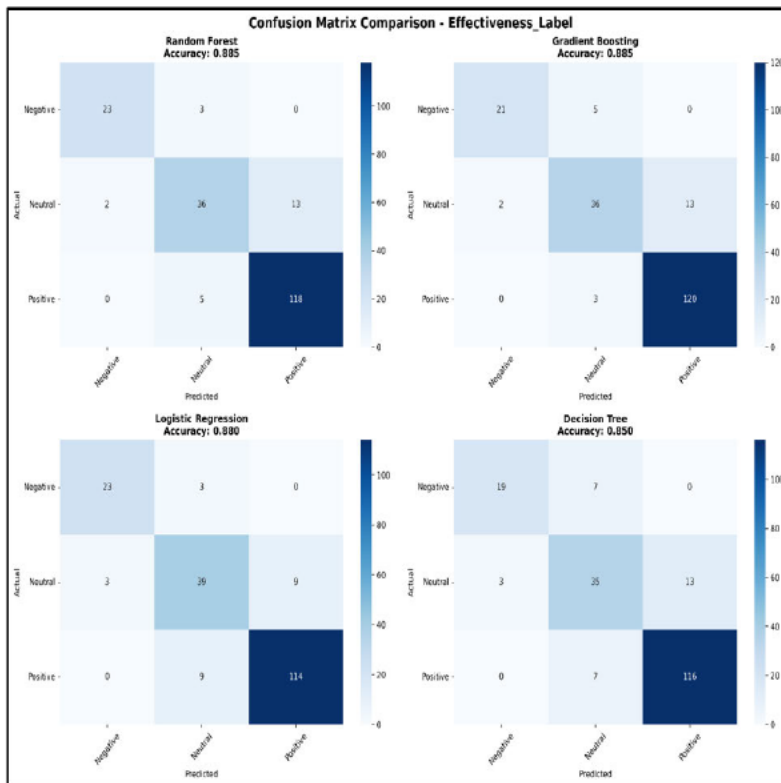
Results: Quantitative Analysis Ph2

What: Confusion matrix compares predictions vs. actuals using TP, TN, FP, FN to judge classifier performance.

Model accuracy: Logistic Regression **88%** › Random Forest **88.5%** (best) › Decision Tree **85%** › Gradient Boosting **88.5%**.

Logistic Regression details: TP=11, TN=12, FP=8, FN=9—near-balanced classes but many errors.

Implication: Performance is only slightly above chance; More dataset for training Model may improve prediction Accuracy.



Performance Metrics

🏆 Best Model

Random Forest

Accuracy: 0.885

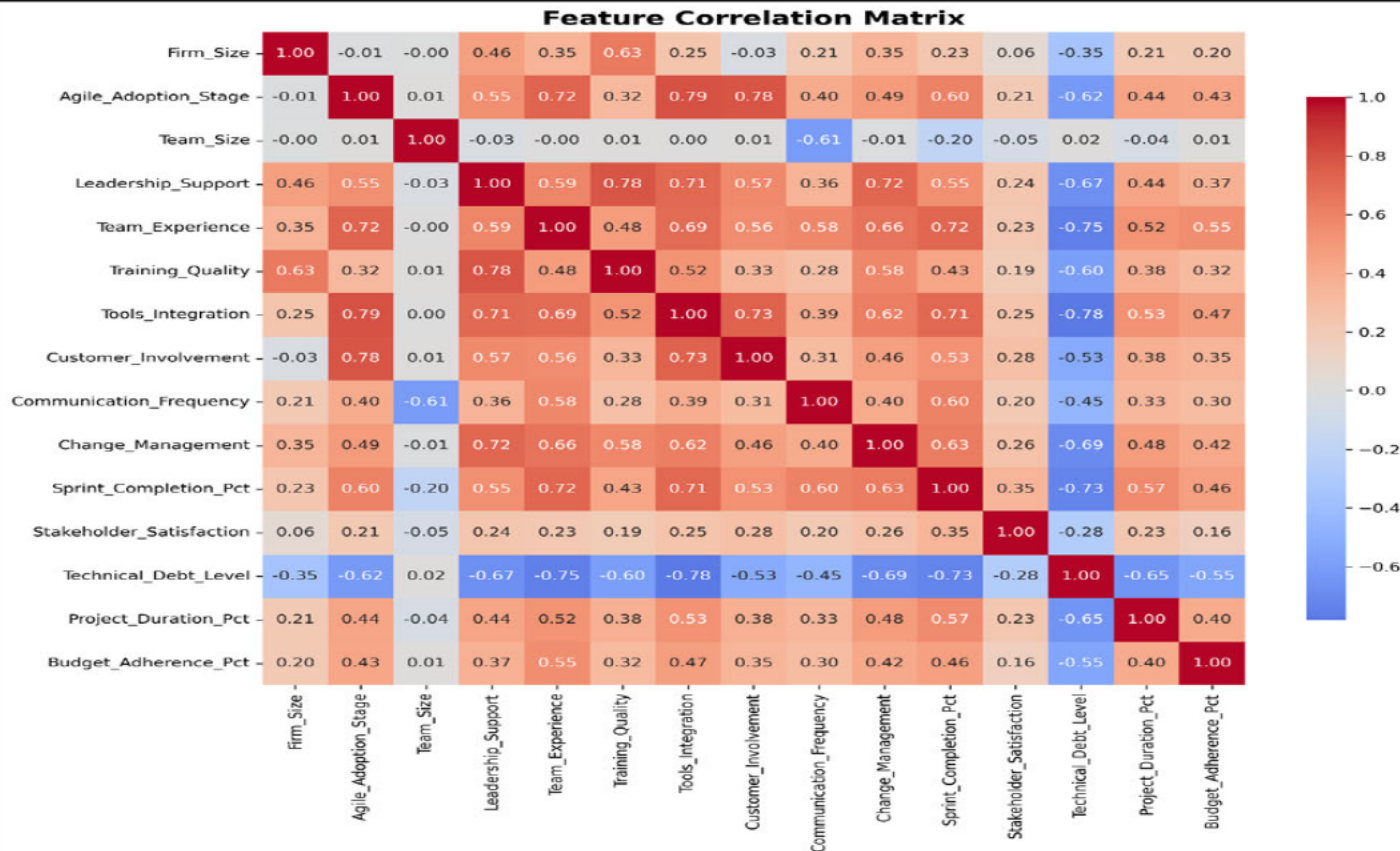
Model	Accuracy	Precision	Recall	F1_Score
Random Forest	0.885	0.8622	0.885	0.8819
Gradient Boosting	0.885	0.8622	0.885	0.8813
Logistic Regression	0.88	0.88	0.88	0.88
Decision Tree	0.85	0.8474	0.85	0.8476

Results: Quantitative Analysis Ph2

What: The Feature Correlation ranked bar chart show how each factor relates to **Project Effectiveness** Label

Why: To pinpoint the strongest drivers of Agile outcomes and focus both management action and feature selection.

How: Compute Pearson correlations and rank by absolute value.

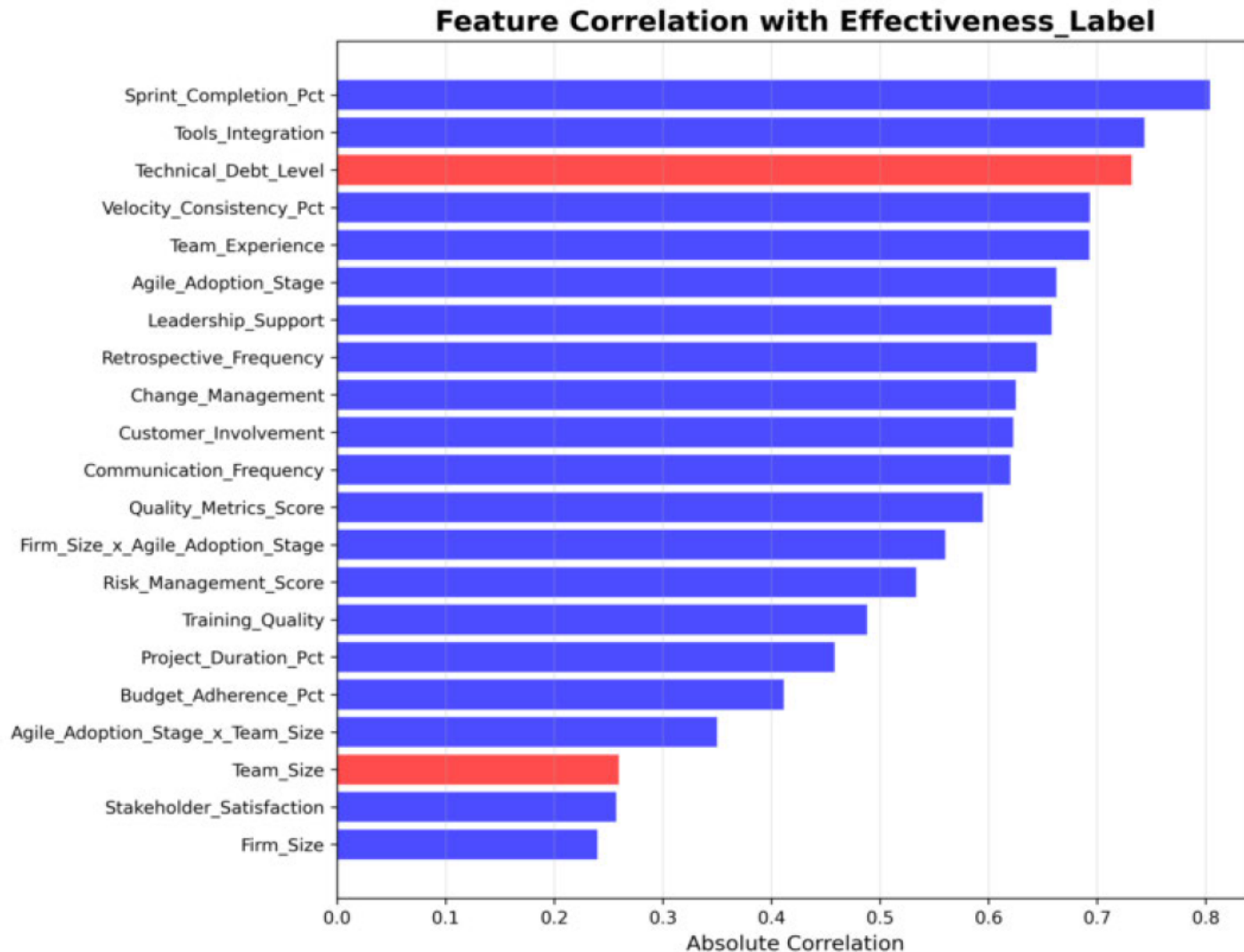


Results: Quantitative Analysis Ph2

What: The Feature Correlation ranked bar chart show how each factor relates to **Project Effectiveness** Label

Why: To pinpoint the strongest drivers of Agile outcomes and focus both management action and feature selection.

How: Compute Pearson correlations and rank by absolute value—Sprint completion, Tools integration, Team experience emerge as the top signals for positive correlation.



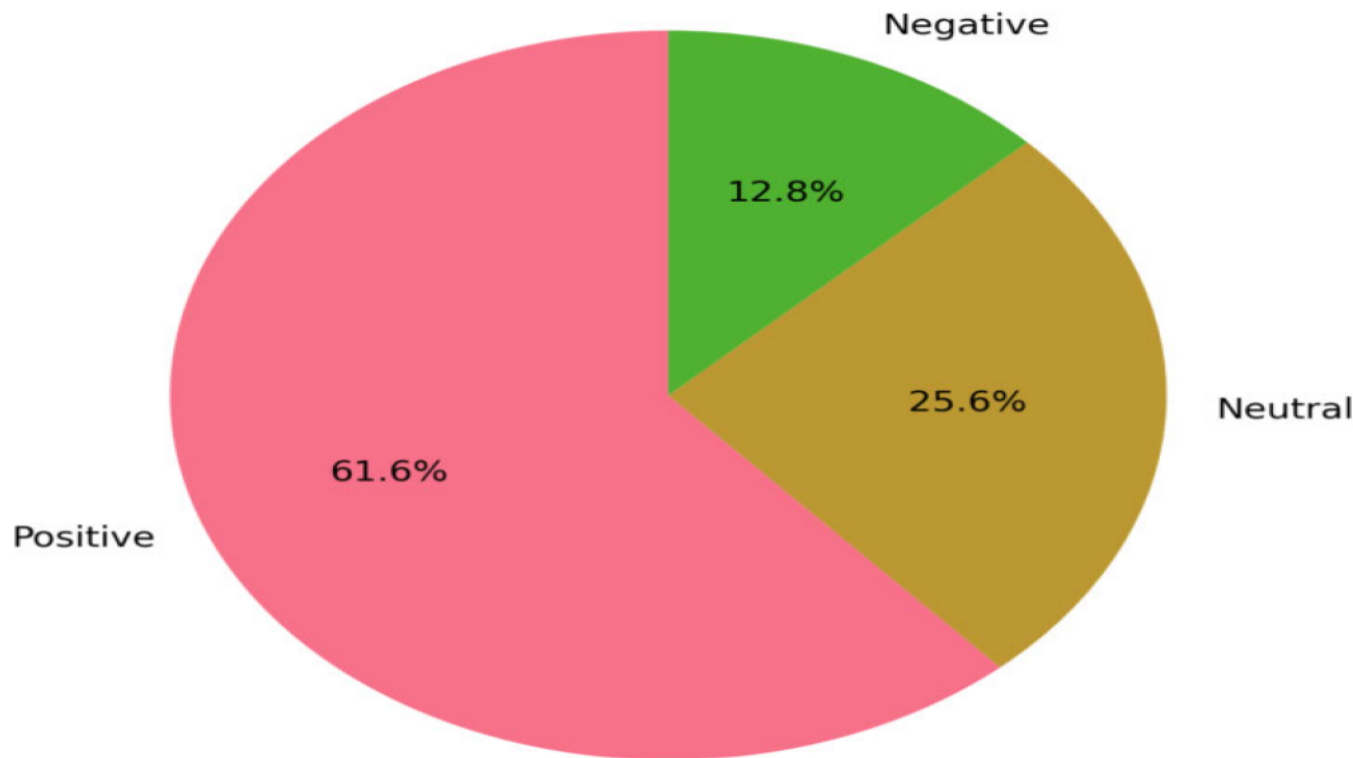
Results & Discussion_ Phase 2 Analysis

What: Agile adoption alone doesn't guarantee success, because not all the success factors show a positive correlation.

Why: Trade-offs are inherent- Improving one area can strain other areas.

Example: Recovering a delayed schedule often requires extra resources or more cost

Effectiveness_Label Distribution



Discussion _ Deployment _ HITMEA Model Demo for Agile PM Predictions

What: A Machine Learning Model developed for Agile Project Management Effectiveness Prediction.

Why: It provides more effective prediction capabilities

How: Leverages proven Machine learning principles for prediction of Target

HITMEA-MODEL DEMONSTRATION

Step 1: Click the link to access the Agile Prediction app

Step 2: Select a Dataset for review

Step 3: Select the best performing predicting Model for your selected Dataset in step 2 above

Step 4: Select different values for each features. Also select industry for sectorial predictions

Step 5: Click the predict button and see the visualization result (Positive, Negative or Neutral outcome)

Dataset 1 Observation

- **Risk Mitigation Per-cost savings:** Increasing this value may lead to negative outcome sometimes as not all risk mitigation results in overall good for the business. Sometimes, it may be beneficial to let the risk event occur.
- **Agile effectiveness per cost saving:** Increasing this value increased positive adoption outcome
- **Time Efficiency:** Increasing time efficiency numbers showed improvement in Agile adoption rate
- **Cost Savings %:** Increasing this feature may not result in an improvement in Agile adoption success rate

Dataset 2 Observation

- **Project duration Pct:** Increasing this feature increased the neutral to negative adoption outcome
- **Budget Adherence Pct:** Increasing this feature increased the neutral to negative adoption outcome
- **Communication:** Increasing this feature increased Positive adoption outcome
- **Sprint Completion Pct:** Reducing this value negatively affected Agile adoption success
- **Sprint Velocity:** Reducing this value negatively affected Agile adoption success
- **Technical debt:** Increasing this feature reduced Agile success possibility

Change Management

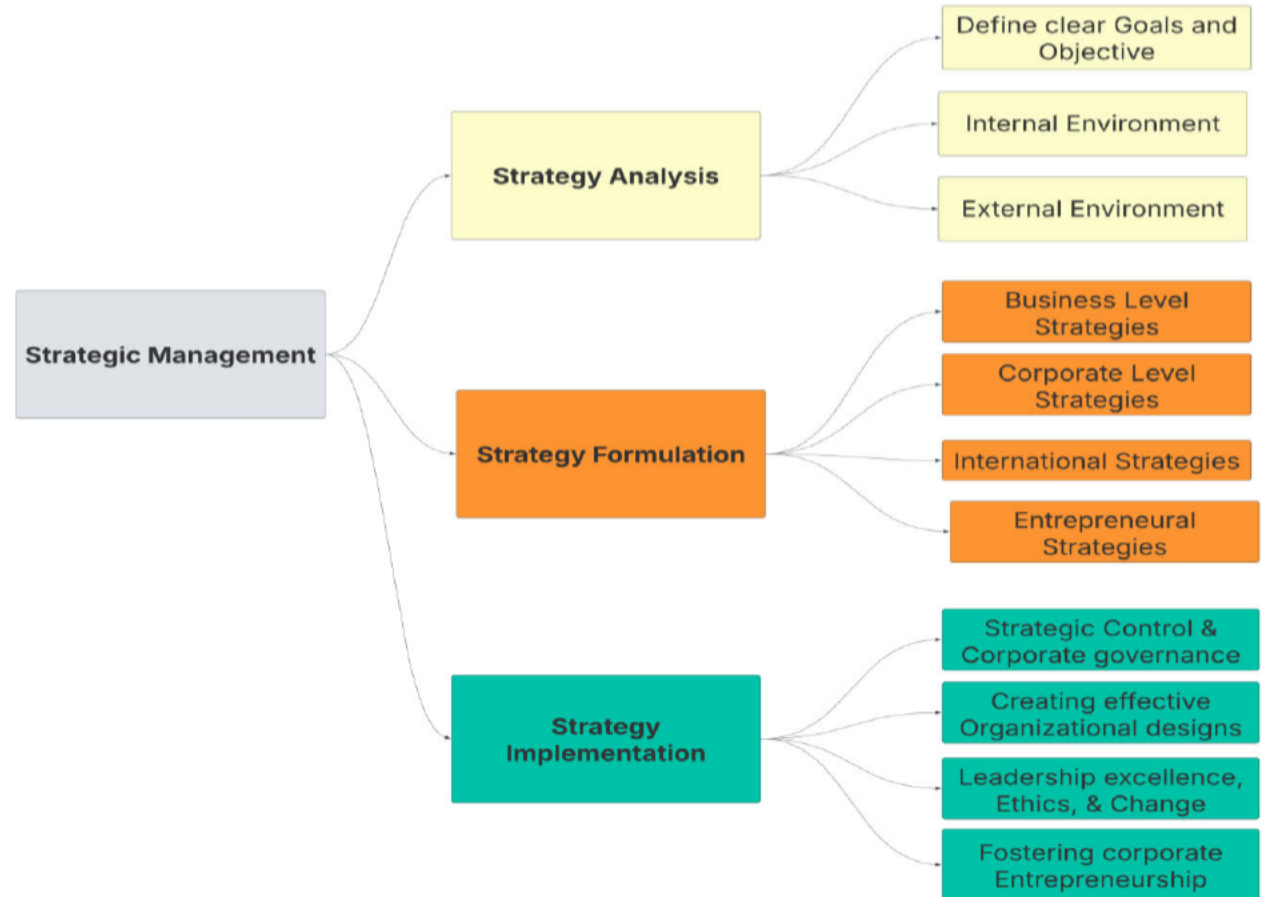
What: A structured, people-first shift that aligns culture, processes, and tooling to deliver value in short, iterative cycles. Change management is crucial in driving organizational change.

Why: Organizations that are highly adaptable to change will most likely achieve success in Agile adoption. This ensures that Agile benefits are realized and sustained

How: Follow a staged roadmap (**Hypothesize & Instrument** → **Test and Measure** → **Extend** → **Anchor**) with executive sponsorship, clear OKRs, targeted comms, coaching/training, and metrics on flow, quality, and outcomes. Grounded upon framework on empirical insights (heat maps, feature correlations, and model results)

	Key results / deliverable	Start date	Due date	Milestones	Resources	Potential blockers	Desired outcomes	To do
Step 1	Plan & set up (Hypothesize + Instrument): baselines, definitions, dashboards, pilot scope agreed	2025-09-04	2025-09-19	Baselines captured; OKRs drafted; dashboard live; sponsor sign off	PO, Scrum Master/Flow Coach, 2 Team Reps, Sponsor, simple dashboard tool	Unclear definitions; low sponsor time; tool access delays	Clear starting point; shared language; score board working; pilot boundaries clear	Collect baseline metrics; define DoR/DoD; set up risk burndown; confirm pilot team
Step 2	Sprint 1 experiment (Test + Measure): tight feedback, daily blocker removal	2025-09-20	2025-10-05	Iteration plan done; daily standups removing blockers; weekly learning review	Pilot team, Flow Coach, PO, quick customer access	Hidden work/WIP; missing customer input; unclear acceptance criteria	Shorter cycle time; visible blockers; first learnings logged	Plan sprint; track cycle time & risks; run end of week review; update playbook
Step 3	Sprint 2 experiment (Test + Measure): refine and confirm improvements	2025-10-06	2025-10-21	Retro actions completed; improved backlog quality; measurable risk burndown	Pilot team, PO, Flow Coach, automation support (as needed)	Metric gaming; scope churn; tool friction	10 to 15% cycle time improvement vs. baseline; fewer open high risks	Tighten Definition of ready (DoR); set WIP limits; pre-mortem for next epic; update dashboard thresholds
Step 4	Extend to 2 or 3 teams (Extend): coach, standardize playbook, align incentives	2025-10-22	2025-11-21	2 - 3 teams onboarded; playbook v1 published; coaching guild formed	Flow Coach(es), Team Leads, HR/Finance partner, simple enablement materials	Capacity limits for coaching; inconsistent leadership messages	Consistent practices across teams; reproducible gains; leaders engaged	Run onboarding workshops; pair on ceremonies; publish v1 playbook; agree rewards
Step 5	Anchor & close the loop (Anchor): governance, policy updates, OKR results review	2025-11-22	2025-12-07	Quarterly review cadence set; policies updated; OKR impact reported	Sponsors, PMO/Finance, Security/Compliance, PO/Flow Coach	Leadership churn; policy change delays	Practices embedded; continued monitoring; sustained improvements	Write policy updates; set QBR & portfolio Kanban; publish results & next-Q OKRs

Strategic Management by SME for Agile Success



Change Management & Strategic Control

Informational Control-Doing the right things

Traditional Approach

- Not a primary means of informational controls

Contemporary Approach

- This is a primary means of control
- Real-time performance Monitoring using Big data analytics
- Market and Competitive Intelligence using Big data analytics
- Customer and Supplier Data Integration using CRM softwares

Behavioral Control – Doing things right

Strong Cultural Behavior

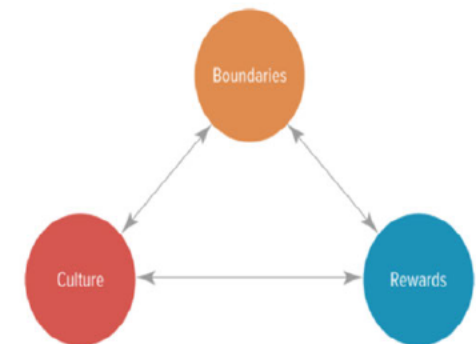
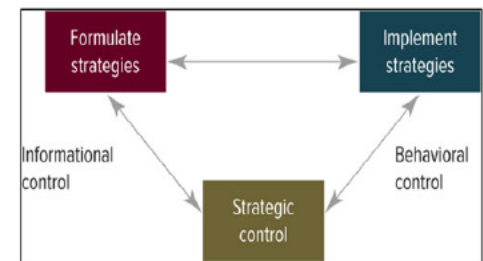
- Corporate Vision & Ethical Leadership
- Diversity, Equity & Inclusion (DEI)
- Employee engagement and leadership development

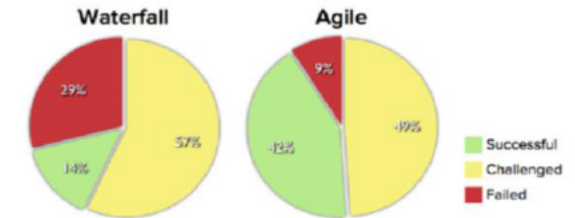
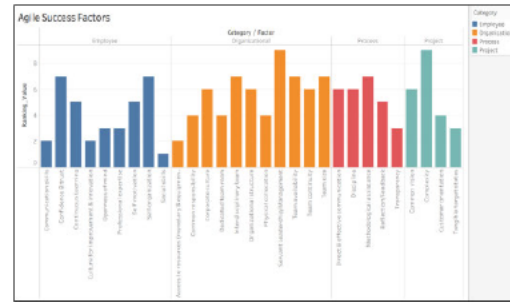
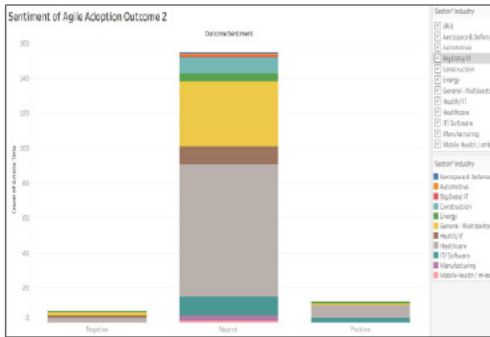
Good Rewards System

- Performance-based compensation
- Recognition Programs

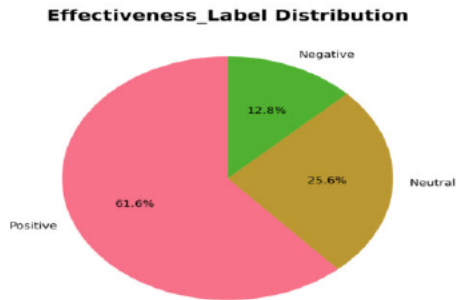
Good Boundary System

- Code of Business conduct
- HSE and product stewardship system





(Carilli, James F., 2013)



Summary of Analysis and Insights



It was difficult to access Agile adoption appraisal across several industries from previous literature research. This is solved now by this research.



No model or app existed for Agile prediction in the past. The gap is closed now by this research.



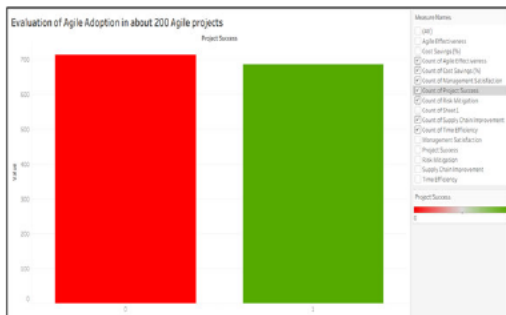
SME should use Strategic Management to Analyze existing strategies, Formulate strategies, Implement strategies, and use strategic control tool to reinforce performance.



SMEs should monitor metrics like Size, Sprint velocity, Sprint completion pct as key indicators. They should also monitor factors such as People, Process, Technology, Organization, Financial and Customer engagement using tools like SWOT, PESTLE, Porters five forces model



Agile adoption is common in projects with high uncertainty which provides high rate of change, complexity and risk, while Tradition PM is common in projects that are well defined, reducing their complexity and risk



Challenges and Limitation



Data Quality and Representation as Kaggle dataset may not fully represent all SME industry contexts or geographic regions



Industry variation as different organizations may interpret and execute agile practices differently



Validation and testing as there is a need for more real-world testing and performance evaluation to assess the accuracy, effectiveness, and efficiency



Deployment as this model, once validated, will need to be deployed to achieve widespread use globally.

Recommendation

- Agile adoption is not always positive—SMEs must balance Agile and plan-driven methods.
- Growth brings challenges: as organizations scale, Agile becomes harder to implement successfully.
- Large firms struggle with agility; SMEs should carefully manage expansion to sustain Agile benefits.
- Effective change management is essential (e.g., **MoSCoW** for priorities, **ADKAR** for behavior change).
- The HITMEA model has established a proof of concept. Future research should enhance the **HITMEA ML model** with broader datasets to improve prediction accuracy.

Next Steps

Access more Databases with historical Agile adoption survey results

Perform more surveys on SME organizations that have transitioned from Traditional to Agile to improve model learning

Improve industry knowledge: Focus on more Sector specific Agile adoption survey e.g. 1000 surveys on Agile adoption in Energy industry (Oil and Gas production and exploration, Renewable energy industry, Engineering, Procurement, Construction, Installation)

Perform more Training and Testing of Predictive Models: Use more quality or audited datasets to improve learnings and insights

Deployment for Large scale use: Market models for large scale adoption by industries and business executives use in scaling organizations feature to drive growth and success in their business



NEXT >
STEPS

Conclusion

Question 1: SME transitioning from Traditional PM to Agile is not always positive. Some features provide positive correlation towards success while other provide negative correlation. Each organization should seek its own balance.

Question 2: Several success factors and barriers exists but can be grouped into six bucket_ People, Process, Technology, Organizational, Financial, and Customer Engagement.

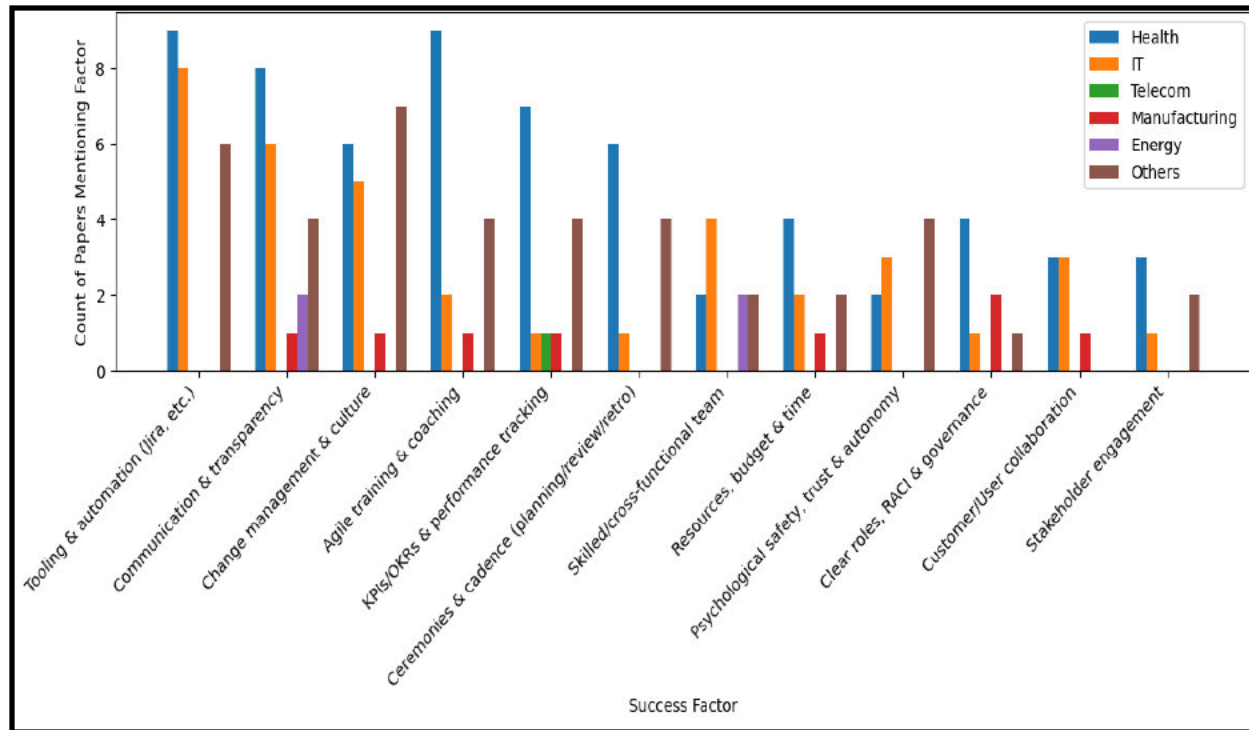
Question 3: HITMEA Machine learning framework together with **Logistic Regression, Gradient Boosting, and Random Forest** are good models for predicting Agile adoption effectiveness. More training datasets are needed to improve accuracy of prediction.

Question 4: In terms of outcome, both Agile and Traditional PM yielded successes and failures upon adoption. Several factors drive outcome, and they must be managed closely. Change management and business Strategic Management is very important to help organization implement changes and drive Agility that aligns with business strategic objective.

CONCLUSION

THANK
YOU!

Backup- Success Factor Across Industries



Backup- Ph1 Variables description table

Variable	Description	Range/Unique Values
1. Agile effectiveness	Measures how well Agile methodologies enhance project management processes.	2 to 5
2. Risk mitigation	Captures the effectiveness of Agile in identifying and reducing risks throughout the project lifecycle.	2 to 5
3. Management satisfaction	Represents how satisfied management is with the outcomes of Agile-implemented projects.	2 to 5
4. Supply chain improvement	Evaluates the impact of Agile practices on optimizing supply chain processes.	2 to 5
5. Time efficiency	Measures improvements in time management within Agile projects.	2 to 5
6. Cost savings	Quantifies the percentage of cost savings achieved due to Agile methodologies.	10 to 48
7. Project Success	0 = Failure/ underperformance while 1 = Success meeting or exceeding objectives.	0, 1

Backup- Ph2 Variables description table

Variable Name	Scale / Range / Categories	Description
1. Industry	Healthcare, Technology, Manufacturing, Energy, Education, Automotive, Construction, Finance, Retail, Government.	The industrial sector in which the organization operates
2. Firm Size	1 = Small (1–50); 2 = Medium (51–200); 3 = Large (201–1000); 4 = Enterprise (1000+)	Organizational size category.
3. Agile Adoption Stage	Scale 1–10	Current maturity of agile implementation.
4. Team Size	Continuous (5–25)	Number of people in the agile team.
5. Leadership Support	Scale 1–10	Level of management commitment and support.
6. Team Experience	Scale 1–10	Collective agile experience of the team.
7. Training Quality	Scale 1–10	Quality of agile training provided.
8. Tools Integration	Scale 1–10	Level of agile tool sophistication and integration.
9. Customer Involvement	Scale 1–10	Degree of customer engagement.
10. Communication Frequency	Scale 1–10	Intensity of team/stakeholder communication.
11. Change Management	Scale 1–10	The organization's ability to manage change.
12. Sprint Completion	Percentage (40–100%)	This is the rate of sprint goals completed.
13. Stakeholder Satisfaction	Scale 1–10	This is a measure of how satisfied stakeholders and end-users of the project's product feel.
14. Technical Debt Level	Scale 1–10	Accumulated technical debt in the codebase.
15. Project Duration	Percentage (70–130%)	Actual duration vs planned duration.
16. Budget Adherence	Percentage (80–140%)	Actual cost vs planned budget.
17. Velocity Consistency	Percentage (50–100%)	Consistency of team velocity across sprints.
18. Quality Metrics Score	Scale 1–10	Composite of code quality metrics.

Backup- 4 Core Values of Agile:



**INDIVIDUALS &
INTERACTIONS**
OVER PROCESSES
& TOOLS



**WORKING
SOFTWARE OVER**
COMPREHENSIVE
DOCUMENTATION



**CUSTOMER
COLLABORATION**
OVER CONTRACT
NEGOTIATION



**RESPONDING TO
CHANGE OVER**
FOLLOWING A
PLAN

Backup - 12 Principles in Agile

- Deliver **customer value early & often**
- **Welcome change**, even late
- **Ship frequently** (weeks, not months)
- **Business + dev work together** daily
- **Support motivated people**; give trust & tools
- Prefer **face-to-face** communication
- **Working product = main progress measure**
- Keep a **sustainable pace**
- Pursue **technical excellence & good design**
- **Simplicity** (maximize work not done)
- **Self-organizing teams** create the best solutions
- **Reflect & adapt** regularly (inspect & improve)



Backup – Role of Change Management

Industry	High-Impact Practices	Metric I Watch
Health	Risk-based testing, compliance-by-design, cross-functional reviews with clinicians.	Cycle time to release; defects in clinical scenarios.
IT/Software	CI/CD, trunk-based development, automated testing; strong backlog hygiene.	Deployment frequency; lead time; change fail rate.
Manufacturing	Kanban with WIP caps, supplier collaboration, and on-style escalation.	Throughput; first-pass yield; downtime MTTR.
Energy	Permit/HSSE integrated into flow, risk pre-mortems for high-stakes work.	Risk burndown; schedule adherence; incident rate.
Aerospace	Model-based systems engineering, rigorous change control, verification early.	Nonconformance trends; verification pass rate.
Agriculture	Iterative trials, farmer feedback loops, simple mobile data capture.	Time-to-validate; adoption rate; cost per outcome.

References

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