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RESEARCH DESIGN OF FROM SPRINTS TO SUSTAINABILITY: THE AGILE–AI–DIGITAL TRANSFORMATION PIPELINE FOR NEXT-GENERATION GREEN PERFORMANCE

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ABSTRACT

This study investigates how Agile practices influence Environmental Sustainability Performance through a sequential mediation pathway involving AI Capabilities and Digital Transformation, with Digital Leadership moderating the final stage of the pipeline. Survey data were collected from 215 professionals across organisations implementing Agile practices. A 27-item questionnaire written in plain language was administered [1, 2]. Seven hypotheses were tested using Partial Least Squares Structural Equation Modelling (PLS-SEM) with bootstrapped significance testing (B = 5,000 iterations) in accordance with Hair et al. [3]. Environmental Sustainability was measured using two distinct items (ES1 and ES3) from the four-item administered scale; the remaining two items exhibited near-identical response patterns and were excluded from analysis to avoid artificially inflated measurement indices.

Keywords

Agile practices, AI capabilities, digital transformation, environmental sustainability, digital leadership, PLS-SEM, composite reliability, discriminant validity, serial mediation.

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INTRODUCTION

Theoretical contribution. N. This research builds upon the dynamic capabilities theory to identify and empirically test sequential causal chain: Agile Practices, AI Capabilities, Digital Transformation, Environmental Sustainability, Performance in one PLS-SEM model and assesses the measurement model for each construct (Outer Loadings, CR, AVE, HTMT).10 Practical contribution. The research develops recommendations for managers and policy-makers concerning the effective sequence of the application of Agile practices, development of AI capabilities, investment in the digital transformation, and its eventual generation of measurable environmental performance benefits.

Most studies examine Agile, AI, and Digital Transformation as parallel-independent phenomena, overlooking their sequential interdependence. No prior study has tested all three as a causally ordered pipeline culminating in Environmental Sustainability Performance within a single integrated SEM framework. The moderating role of Digital Leadership within this pipeline has received very limited empirical attention (Reyna-Vargas, 2024).

2. RESEARCH DESIGN

This study employs a quantitative empirical research design using a cross-sectional survey, with the model tested simultaneously using PLS-SEM following Hair et al. (2019). PLS-SEM was selected because it: (1) tests the full model simultaneously rather than path-by-path; (2) is appropriate for complex models with serial mediation and moderation; (3) does not require multivariate normality; and (4) is consistent with the exploratory-confirmatory nature of this study.

POPULATION AND SAMPLING

The sample of population is comprised of project managers, team leads, IT practitioners and employees that are involved in digital and sustainability related activities within organizations which apply Agile methods. Sampling strategy was purposive.

Sample Size Justification. A minimum sample size was identified using the rule of 10 by Hair et al. (2019), which recommends ten respondents per indicator to the path which has the highest number of incoming arrows. Environmental Sustainability has two incoming structural paths (DT and DL) and 5 indicators in the largest construct with two antecedent paths. Therefore the minimum is N=50. The aim sample size of N = 215 exceeded the minimum requirements for a sample size. After deleting 18 respondents for missing items on item columns in the converted data file, usable sample size was N=215, satisfying all of PLS-SEM requirements.

DATA COLLECTION

Data Collection Instrument

Data was obtained through a structured online survey that was distributed through LinkedIn, direct e-mail invitation and snowballing. Items were responded to using a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). The survey constructed has 27 items that represent the five constructs mentioned. As shown, it was intended that Environmental Sustainability be a four-item scale, although upon examination of the data file administered it was evident that ES2 was identical to ES1 and ES4 nearly identical to ES3 (r = 0.997, one row missing). Thus the final analysis included only the two truly different items for Environmental Sustainability (ES1 and ES3).

Table 1.

Key Variables and Measurement

Variable	Type	Description / Items in Analysis
Agile Practices	IV	6 items: iterative, incremental, retrospective, self-organized dimensions
AI Capabilities	Mediator 1	4 items: AI integration, efficiency, decision support, performance (Zeng et al., 2022)
Digital Transformation	Mediator 2	6 items: digital technology usage, adaptability, habit, usefulness, continuance
Environmental Sustainability	DV	2 distinct items (ES1, ES3) used in analysis; ES2=ES1, ES4≈ES3 excluded
Digital Leadership	Moderator	5 items: digital vision, empowerment, motivation, strategic alignment

Table 2.

Variables and Measurement Sources

Construct	Measurement Source	Items (designed → analysed)
Agile Practices	Tripp et al., 2016; Rietze & Zacher, 2022	**12 → 6 items**
AI Capabilities	Zeng et al., 2022; Somanathan, 2025	**7 → 4 items**
Digital Transformation	Zincirli & Polat, 2025	**8 → 6 items**
Environmental Sustainability	Iqbal & Ahmad, 2021; Martens & Carvalho, 2017	**5 → 4**
Digital Leadership	Reyna-Vargas, 2024	**6 → 5 items (observer-rated)**
Construct Variables		**2**

Plain Language Adaptation and Questionnaire Length

The questionnaire items were rewritten using plain language principles (Bauer et al., 2025) and designed to **27** items following the 25–30 item recommendation of Sharma (2022). Plain language has been shown to reduce satisficing behaviour and item nonresponse, particularly among respondents with lower literacy skills or non-native language backgrounds.

Table 3.

Original vs. Plain Language Item Examples

Construct	**Original Wording**	**Plain Language Version**
Agile Practices	At the beginning of each work cycle, the team and business owners agree on what will be delivered.	At the start of each work cycle, our team agrees on what tasks will be done.
AI Capabilities	Adoption of AI in our operations is more cost effective compared to other technologies.	Using AI in our work saves us time and money.
Digital Transformation	I think that I will continue to use digital technologies.	I plan to keep using digital tools in my work in the future.
Env. Sustainability	Your organization uses utilities in an environmentally friendly manner.	Our organisation uses energy and water carefully to protect the environment.
Digital Leadership	I am driving the digital transformation forward proactively in our unit.	My manager actively drives digital change in our team.

Table 4.

Final **27**-Item Questionnaire Structure

Construct	**Role**	**Items (designed)**	**Items (analysed)**
Agile Practices	IV	6	6
AI Capabilities	Mediator 1	4	4
Digital Transformation	Mediator 2	6	6
Env. Sustainability	DV	4	2 distinct (ES1, ES3)
Digital Leadership	Moderator	5	5
Control Vaeiable		**2**	
TOTAL	—	**27**	23 distinct items

Data Collection Procedure

Data were collected via Google Forms and email-distributed survey links. A screening question confirmed Agile methodology use before the main instrument was administered. After removing 18 respondents with missing data in the converted data file, the final usable sample was N = **215**.

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