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ORIGINAL CONTRIBUTION

Executive Digital Cognition, Policy Incentives, and Innovation Performance: The Mediating Role of Enterprise Digital Behavior

Mingzhi Liu[1], Aroonroj Boonkrong[2]*, Khunanan Sukpasjaroen[3]

[1, 2, 3]Chakrabongse Bhuvanarth International College of Interdisciplinary Studies, Rajamangala University of Technology Tawan-ok, Bangkok, Thailand

Abstract— Digitalisation will not increase the level of innovation; rather, it is the effective utilisation of new-age resources by managers that can improve innovation performance. Based on the theories of upper-echelon and stakeholder, this paper investigates how executives' digital cognition and policy incentives affect enterprise innovation performance through enterprise digital behaviour. An explanatory sequential mixed-methods design was used to conduct a two-wave survey of 430 managers at Chinese manufacturing enterprises and five interviews with academic experts and manufacturing managers. Structural Equation Modelling showed that executives' digital cognition and policy incentives positively affect enterprise digital behaviour and innovation performance, and enterprise digital behaviour is also positively correlated with innovation performance. Decomposition of the reported effect indicated partial mediation by enterprise digital behaviour. The four explanatory pathways of this thematic analysis are: Cognitive framing and strategic authorisation; policy support as resource relief and institutional validation; behavioural conversion through organisational reconfiguration; and innovation realisation and feedback. The study provides an institutional-managerial explanation of digital transformation by showing that executive interpretation and policy support create innovation value through the activation of management digitisation, business digitisation and ecosystem integration. The results provide a reference for building executive capabilities and behavioural-oriented digital policies.

Index Terms— Executives' digital cognition, Policy incentives, Enterprise digital behavior, Innovation performance, Manufacturing enterprises, Digital transformation

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Introduction

Digitalisation is no longer a problem of IT; it has become an essential way for enterprises to create value and run their businesses in the age of the digital economy. Digital technology can reduce the development period, support data-intensive experiments, improve cross-functional coordination, and connect with external knowledge sources. However, if this technology does not meet the company's goals and the decisions of top management, there will be dispersed investments, organisational resistance, capability gaps, and rising coordination costs. Therefore, the two companies have had different results in their technology-driven innovation activities. Therefore, digital transformation should not be viewed merely as the adoption of tools; rather, it is a process of organisational renovation in which leaders interpret technological changes, allocate attention and resources, and redesign routines (Verhoef et al., 2021; Vial, 2021; Warner & Wäger, 2019).

*Corresponding Author: aroonroj_bo@rmutto.ac.th

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The production environment is relatively difficult to address. Manufacturing enterprises should connect digital systems with physical assets, production processes, quality control, supply chains, and developed workforce capabilities. A digital initiative that remains in one department will not help to improve product development or commercialisation. Innovation benefits arise from the integration of digital technology in management processes, operations, and relationships among organisations. Accordingly, existing research links digital capabilities and transformation to innovation and performance, but also shows that this relationship depends on complementary organisational resources and managerial action (Khin & Ho, 2019; Siachou et al., 2021; Sousa-Zomer et al., 2020).

The two are good causes but rarely happen together. First, executives' digital cognition refers to the system of interpretation used by top decision-makers to recognise the advantages of digitalisation, respond to external pressures, assess organisational readiness, and decide on adaptation requirements. Upper echelon theory believes that strategic choices are based on the experiences, values, and cognitive foundations of top managers (Hambrick, 2007; Hambrick & Mason, 1984). Cognition is a person's awareness of whether new technology is an extension of their work, an added responsibility, or a chance to learn in the digital era. Strong digital cognition can focus organisational attention, build an integrated transformation story, and justify the redistribution of resources to uncertain innovation activities.

Recently, some studies have shown that executives are more involved in the interpretation of information. Executive IT experience can focus attention on innovation in digital technology (Cao & Wu, 2025), and CEO digital embeddedness may affect performance through top-management creativity and entrepreneurial agility (Yin et al., 2025). General managerial skills, overconfidence, equity incentives, and CEO–TMT cognitive complementarity also affect transformation decisions; however, their impact varies according to performance feedback, financial slack, market competition, and the specific circumstances of strategic decisions (Cao & Wu, 2025; Chen & Sui, 2025; Cui & Meng, 2025; Lyu et al., 2025). Recent studies have identified the effect of top management but have not explored all the paths. Therefore, in the present study, executives' digital cognition is directly measured, and enterprise digital behaviour is identified as the path for organisational transformation.

The second reason is policy incentives. Digitalisation is generally capital-intensive and requires talented people, complementary facilities, etc., and cooperation among enterprises. Subsidies, tax reductions, technical services, standards, demonstration projects, and market-facilitation measures can reduce financial and information asymmetry. Policy incentives also signal the government's priorities and affect the expectations of customers, suppliers, investors, local institutions, etc. Research on the effect of innovation policies shows that support instruments are not uniformly effective; their value depends on whether firms have the awareness and organisational capacity to utilize such support and convert it into actions (Czarnitzki & Lopes-Bento, 2014).

Three gaps motivate the present study. Firstly, research on managerial cognition, government support, digital transformation, and innovation performance is fragmented across various bilateral relationships, and the interplay of internal interpretation, and external institutional support in the same organisation has not been systematically explored. Second, digitalisation is often presented as an abstract state, a pool of technology or ability, and it is not specified how organisations actually turn the previous conditions into innovation results. Therefore, this study conceives of enterprise digital behaviour as enacted management digitisation, business digitization, and digital ecosystem integration. Third, policy incentives are often used as direct inputs or contextual conditions in the model, and less attention has been paid to how the innovative value of these incentives can be realised through organisational digitalisation. Therefore, comprehensive tests of cognition, policy support, behavior, and performance under a single system are needed.

Therefore, this paper will examine whether the digital cognition and policy incentives of executives affect enterprise innovation performance, and how these changes are reflected in changes in enterprise digital behaviour. A delayed survey of 430 managers in Chinese manufacturing enterprises was subjected to structural equation modelling and further augmented by five academic experts' and five manufacturing managers' interviews. Theoretically, it is intended to be an expansion and integration of existing research rather than the construction of a new cognition-behaviour-performance mechanism. Specifically, this study integrates executive digital cognition and policy incentives within an institutional-managerial system to explore enterprise digital behaviour as a form of organisational transformation and differentiates between direct and behaviourally transmitted paths to innovation performance.

Literature Review

Theoretical foundations

The primary micro-foundation for explaining executives' digital cognition is provided by upper-echelon theory. According to the theory, managerial background and personality factors in executives are associated with changes in organisational performance because of limited rationality (Hambrick & Mason, 1984). Later, research has focused on discretion and cognition rather than on demographic proxies (Hambrick, 2007). Digitalisation also provides support for this purpose; however, the technological pathway remains uncertain, and the return on investment will be delayed. Therefore, top management will pay attention to some signals in responding, create an appropriate level of uncertainty, and develop a digitalisation plan. Digital knowledge and top-management interfaces can thus affect digital innovation and strategic direction (Firk et al., 2022; G. Li & Shao, 2023; Wrede et al., 2020).

Building on Upper Echelons Theory, Strategic Cognition Theory investigates the mental models that leaders use to perceive, understand, and respond to strategic circumstances. Cognition is not only knowledge of a technology. It is the set of beliefs concerning the reasons for

expected gains, the interpretation of demands from the environment, and the assessment of the organisation's capacity to adjust structures, skills, and processes. These beliefs affect the division of attention and resources. Therefore, strong digital cognition should increase the probability of leadership support for digital projects, align business, and technology priorities, and tolerate experimentation. Cognition cannot enhance performance by itself in the minds of executives; it must be manifested in organisational behaviour.

Stakeholder Theory explains the function of policy incentives. Governments are powerful stakeholders because they set the rules, control funds, provide infrastructure, and public services (Freeman, 1984). Policies guide firms by means of resources and signals. Resource mechanisms reduce the cost and risk of digital investment, and signalling mechanisms communicate which technologies and development paths are legitimate and strategically important. Innovation policy can also correct for coordination and knowledge-market failures (Edler & Fagerberg, 2017). External support is still an enabling condition. Firms still need to choose projects, redesign routines, and integrate technologies before the support can promote innovation.

The three aspects are in a cognition-support-behaviour-performance sequence. Executives' cognition provides interpretation and strategic direction; policy incentives supply resources, legitimacy, and reduced uncertainty; enterprise digital behaviour is the organisational enactment; and innovation performance reflects the resulting product/service innovation, market outcomes, and innovation-resource efficiency. This sequence is also in line with dynamic-capability research, which considers managerial sensing and resource orchestration as micro-foundations of organisational renewal (Teece, 2007; Warner & Wäger, 2019).

Upper echelons theory in the digital transformation context

At first, the theory of upper echelons tried to explain why organisations in similar environments chose different strategies. Its purpose is not to have executives determine the results freely, but rather to limit the focus and interpretation of complex circumstances through constrained management. Observable organisational choices are thus the result of the executives' assessment of the environment and their subsequent decisions (Hambrick & Mason, 1984). This logic is particularly suitable for digitalisation because the economic value of technology is not always obvious. Artificial intelligence, industrial Internet platforms, cloud services, and digital twins can support optimisation, exploration, coordination, or business model innovation. The importance of a certain technology to the company depends on how closely it relates to the company's problems, resources, and other competitive factors.

Strategic cognition and organizational enactment

Strategic Cognition Research Explains Why Interpretive Structures Are Adaptive. The Categories of reduction by managers include causal maps and assumptions about competitors, technology, and organisational capacity. Although the above structures can work together, they may also be slow to respond to changes in the environment because they are outdated. Digitalisation has generated problems for the traditional cognitive categories by blurring the boundaries of products and services, internal and external activities, and operational and strategic information. Leaders need to reconsider the core strengths of the company and its value-creating locations at the top.

Stakeholder theory, policy incentives, and institutional signals

Stakeholder theory expands the focus of analysis beyond top management to include all groups that are affected by and thus have an interest in the company's legitimacy (Freeman, 1984). Government is also engaged in the digital transformation process. It can fund infrastructure, subsidise equipment and R&D, build technical standards, organise demonstration projects, provide access to data and platforms, offer training, and create demand through procurement or market-development programmes. The above measures change the resources available to enterprises and alter the foundation of management expectations.

Enterprise digital behavior as a conversion mechanism

Research on digitalisation is conducted at two levels. One school of thought views digitalisation as a type of technological resource or ability, while the other thinks it is a reform of strategy and organisation. Both views indicate that technology ownership is not enough; rather, value is generated through modifications to structure, routine, and the process of value creation (Verhoef et al., 2021; Vial, 2021; Warner & Wäger, 2019). Digital behaviour in enterprises refers to realised managerial and operating practices, not intentions or the availability of technology for addressing the transformation problem.

Digitisation of management incorporates integrated information, analysis, and digital systems in planning, coordination, control, human resources, and decision-making. Business digitalisation applies digital technology to research and development, production, logistics, marketing, sales, and service, and digital ecosystem integration connects the company with suppliers, customers, platforms, universities, and service providers. Together, these practices improve the visibility of information, experimentation, traceability, customization, and knowledge coordination (Bharadwaj et al., 2013; Sousa-Zomer et al., 2020; Vial, 2021).

Enterprise innovation performance as a multidimensional outcome

Multidimensionality of Innovation Performance. Product and service innovation refers to the introduction of new or significantly improved products and services; market performance reflects customer acceptance and competition results; and innovation-resource allocation efficiency shows how effectively capital, knowledge, talent, and time are used for promising projects. Digital technology can be applied at all stages of innovation to boost R&D efficiency and commercialisation (Ferreira et al., 2019; Khin & Ho, 2019).

Executives' digital cognition and enterprise innovation performance

Executives have gained some awareness of the importance and requirements of the digital age through learning. Expected-benefit cognition links digital investment with productivity, customer value, speed, and competitive advantage; pressure perception observes changes in customers, competitors, industry standards and policies; adaptability cognition addresses the structural, skill, and process changes required for implementation (Kindermann et al., 2021; G. Li & Shao, 2023; Ma & Wei, 2025).

Executives' cognition affects innovation performance by shaping the strategic direction, investment period, and governance structure, etc., of senior management. Leaders who believe that digitalisation is a chance for experimentation and knowledge recombination are more likely to support exploratory projects and integrate departmental information. This is consistent with the research on digital orientation, executive IT backgrounds, and the ways top executives shape innovation (Cao & Wu, 2025; Kindermann et al., 2021; Zhu et al., 2025). Therefore:

This is consistent with the recent high-level observations. Zhu et al. (2025) have proposed several ways for top executives to promote innovation, including attention and motivation, human capital, power, and social interaction. Ma and Wei (2025) further show that executive cognition can enhance the performance of digital green innovation in building-material enterprises through capability reconstruction. Similarly, executive IT background and CEO digital embeddedness have also been associated with digital innovation or firm performance (Cao & Wu, 2025; Yin et al., 2025). The above studies support the idea of a direct cognition-innovation linkage and have also shown that this link is mediated by organisational processes.

H1: Executives' digital cognition positively affects enterprise innovation performance.

Executives' digital cognition and enterprise digital behavior

Enterprise digital behaviour refers to the specific organisational behaviour of applying digital technology in management, operations, and external relations by a company. Because of the budget reallocation and changes in decision-making authority that will occur, executive approval and coordination are needed. Strong digital cognition can reduce the ambiguity of interpretation, establish digital priorities, and shift management focus to whole-organisation action (Cao & Wu, 2025; Chen & Sui, 2025; Wrede et al., 2020). Therefore:

The executive-behaviour connection has also been observed in recent studies with different executive attributes. General managerial skills of CEOs support digital transformation through cognition, risk-taking, and coordination, and performance feedback and financial slack are important contingencies (Chen & Sui, 2025). CEO overconfidence can promote entrepreneurial orientation and transformation behaviour in specialised enterprises (Cui & Meng, 2025), but the impact of executive equity incentives on enterprise digital transformation is context-dependent (Lyu et al., 2025). Innovation-performance shortfalls may motivate manufacturing enterprises to advance digitalisation and reinforce the leading role of CEOs in strategy (D. Li et al., 2025). Together, these results support the hypothesis that top-level management behaviour changes following the introduction of digitalisation.

H2. Executives' digital cognition positively affects nterprise digital behaviour.

Enterprise digital behavior and innovation performance

Digitisation of management enhances information quality and cross-functional cooperation in decision-making; business digitalisation incorporates data and digital tools across R&D, production, marketing, and service; and ecosystem integration connects enterprises with external knowledge and auxiliary resources. Such behaviour will increase the speed and scope of knowledge recombination and improve innovation output and resource allocation efficiency (Ferreira et al., 2019; Khin & Ho, 2019; Sousa-Zomer et al., 2020). Wu and Shi (2025) have discovered that digitalisation promotes innovation in renewable energy for manufacturing through peer influence and green cognition, and behaviour and cognition can reinforce each other over time. Cao and Wu (2025) have demonstrated that a strategy of digital innovation creates corporate value under certain CEO-TMT cognitive and incentive arrangements. Based on the above analysis, the firm can enhance the effects of digital behaviour by coordinating conflicting demands and complementary abilities at the executive level.

H3. Enterprise digital behaviour positively affects enterprise innovation performance.

Policy incentives, digital behavior, and innovation performance

Policy incentives can promote the adoption of digital technologies by easing investment and risk. Subsidies and tax policies improve affordability; technical services and public platforms reduce the capability gap; standards, demonstration projects, and market-facilitating policies increase

expected demand and legitimacy. Evidence from research on innovation policy and Chinese manufacturing shows that the effect of such support depends on policy design, accessibility, and the firm's ability to implement digital transformation (Czarnitzki & Lopes-Bento, 2014; Lyu et al., 2025; Zhao et al., 2010) Therefore:

H4. Policy incentives promote the digitalisation of enterprises.

Public funds provide research and development funds; procurement and market-entry programmes support commercialisation; standards and technical services reduce search-and-comply costs. Policy signals can also enhance the confidence required for long-term innovation, but organisational implementation is still required for sustained effects (Czarnitzki & Lopes-Bento, 2014; Zhao et al., 2010) Therefore:

H5. Policy incentives positively affect enterprise innovation performance.

Mediating role of enterprise digital behavior

A cognition-performance relationship that ignores behaviour assumes that managerial understanding is automatically translated into organisational values. Executives' beliefs affect innovation through resource commitments, routine redesign, capability reconstruction, and coordination of digital initiatives in practice. Thus, the main conversion path is enterprise digital behaviour, and the remaining direct paths include non-digital governance, talent, and strategic alliance mechanisms (Ma & Wei, 2025; Yin et al., 2025; Zhu et al., 2025).

H6. Enterprise digital behaviour mediates the positive effect of executives' digital cognition on enterprise innovation performance.

The policy incentive conversion logic is the same. Subsidies, technical support, and market facilitation create potential value; however, this value will only become innovation output when enterprises implement digital management of business and ecosystems. A remaining direct effect is plausible because policies can also fund R&D and improve commercialisation opportunities independently of the measured digital behaviour (Wu & Shi, 2025; Zhao et al., 2010).

H7. Enterprise digital behaviour mediates the positive effect of policy incentives on enterprise innovation performance.

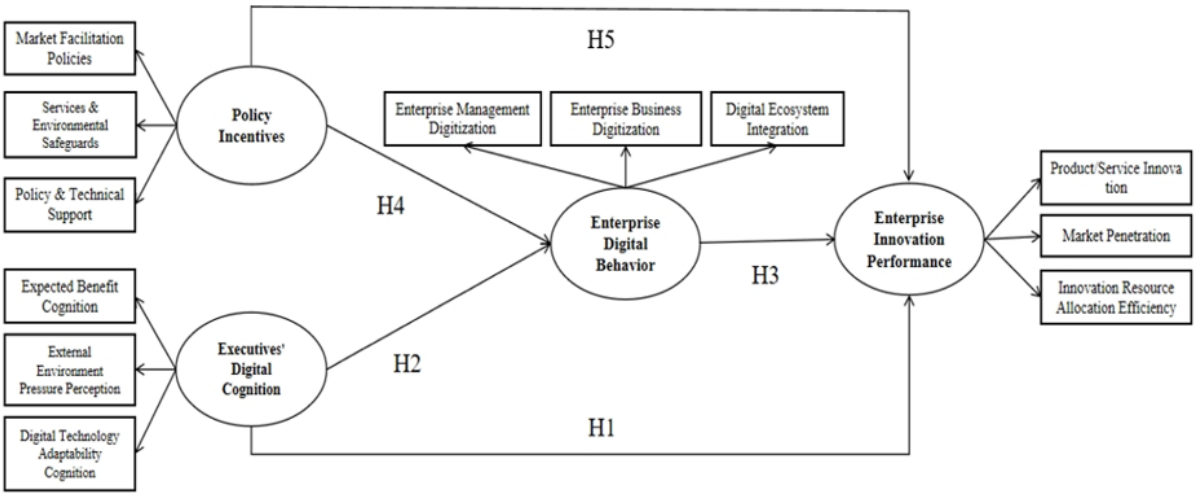

Fig. 1 *Conceptual model of executives' digital cognition, policy incentives, enterprise digital behavior, and innovation performance*

Method

Research design and sample

The research used an explanatory sequential mixed-methods design. The first part of quantification collected related quantitative data and tested the hypothesis; interpretation and corroboration were performed in the qualitative phase. The target group was managers of Chinese manufacturing enterprises, and the sampling frame was provided by the Ministry of Industry and Information Technology's list of manufacturing single-champion enterprises. Managers were suitable respondents because they were well-versed in the company's strategies, digital construction, policy support, and innovation results.

Quantitative data were collected in two time periods, in August and September 2025. The first stage observed executives' digital cognition and policy incentives; the second recorded the enterprise's digital behaviour and innovation performance. The confidentiality of responses was maintained. Via professional survey platforms, industry association contacts, enterprise networks, and visits to manufacturing clusters in eastern, central, and western China, questionnaires were distributed. After excluding the incomplete and low-quality responses, 430 valid matched questionnaires were obtained. According to Yamane's formula, the lower bound of conservativeness for this sample is about 323, and thus it meets the conditions for covariance-based structural equation modelling.

The samples cover all industries, forms of ownership, firm ages and sizes, and regions. As summarized in Table I, 66.3% of respondents were male and 33.7% female. The oldest group was aged 26-35 (41.2%), followed by those aged 36-45 (27.9%). Half of the enterprises were private-owned, and there were also some state-owned/state-controlled and foreign-invested enterprises. Although the organisation has some divisions, it is not a random selection of Chinese manufacturing enterprises.

A two-wave design was employed to increase the time lag between the antecedents and outcomes. At Time 1, respondents evaluated the executives' digital cognition and the policy incentives for their enterprises. At Time 2, they reported on enterprise digital behaviour and innovation performance. Dividing the observations across two time points helped reduce the respondents' capacity for deduction of the whole model based on their answers and lower consistency motives that may strengthen the association in a single questionnaire. Although the absence of time separation does not rule out common-method bias, both are management's reports and therefore offer a relatively reasonable procedural guarantee in the absence of archival data.

Some extra quality-control measures were added. Invalid answers, such as those that were too short or repeated the same answer several times, and those without content were all excluded. Wave matching requires the same anonymous ID. Regarding the confidentiality agreement, research on the company's process was carried out; no specific managers were interviewed. Therefore, they hoped to reduce careless answers and pressure from social desirability. The final 430 observations have a suitable ratio of the sample size to the number of latent constructs and structural parameters.

Table I
Selected characteristics of the survey sample (*N* = 430)

Characteristic	Category	*n*	%
Gender	Male	285	66.3
	Female	145	33.7
Age	18–25	57	13.3
	26–35	177	41.2
	36–45	120	27.9
	46–55	61	14.2
	56 and above	15	3.5
Industry	Electronic equipment	142	33.0
	Mechanical products	112	26.0
	Medicine and chemicals	94	21.9
	Other manufacturing	82	19.1
Ownership	State-owned/state-controlled	97	22.6
	Private	215	50.0
	Foreign	72	16.7
	Other	46	10.7

Measures

All the main contents were given a five-point Likert scale, and 1 was ”strongly disagree” and 5 was ”strongly agree”. Adaptation of existing studies to the Chinese manufacturing environment and modification of items. Five experts have evaluated the offensiveness, relevance and congruence with constructs of the items. Executives' digital cognition included expected-benefit cognition, external-environment pressure perception, and digital-technology adaptability cognition. Policy incentives included policies and technical support, service- and environmental support, and market-facilitating policies. Enterprise digital behaviour includes management digitalisation, business digitalization, and digital ecosystem integration. Enterprise innovation performance includes product/service innovation, market performance, and innovation-resource allocation efficiency. Table II shows the operationalisation.

Expected-benefit cognition items determined whether executives believed that production and management efficiency, business benefits, competitive advantages, and organisational viability had increased as a result of digital technology. External Pressure refers to the expectation of other parties in society or industry for more digital functions. Adaptability is one's awareness of changes in the world, learning ability, and flexible thinking. The system has an explanatory function for the changes outside and within a specific area of study.

Policy and technical support items assessed the availability of formal guidance, technical assistance, and other public support. Service and environmental support refer to the general implementation environment and services that promote digitalisation. Market-facilitation items addressed policies to improve market access and demonstration/commercialisation conditions. Therefore, the index may reflect the company's perception of the policy environment rather than the actual availability of national policies. Programs will only change the behaviour of the organisation if they are available to and understandable by the people in charge.

Enterprise digital behaviour items assessed whether digital technology has been applied to management activities, business operations, and ecosystem relationships. Therefore, the items correspond to the organisation's actual implementation rather than the executives' desired future adoption. Innovation-Performance items showed improvements in products and services, market results, and the efficiency of innovation-resource

allocation. Perceptual indicators are suitable for processes that are not uniformly disclosed by private, state-owned, and foreign enterprises; however, in the future, triangulation with patents, new-product sales, process-cycle time, and R&D productivity should be considered.

Table II
Construct operationalization and descriptive statistics

Construct	Dimensions	Items	Mean range	SD range
Executives' digital cognition (EDC)	Expected benefits; environmental pressure; technology adaptability	12	3.459–3.507	0.519–0.582
Policy incentives (PI)	Policy/technical support; service/environmental support; market facilitation	9	3.511–3.543	0.542–0.555
Enterprise digital behavior (EDB)	Management digitization; business digitization; ecosystem integration	12	3.499–3.544	0.558–0.563
Enterprise innovation performance (EIP)	Product/service innovation; market performance; innovation-resource efficiency	9	3.505–3.531	0.547–0.582

Data analysis and qualitative triangulation

Data screening, descriptive statistics, reliability tests, exploratory factor analysis, and common-method bias diagnostics were performed in SPSS, and confirmatory factor analysis and structural equation modelling were conducted in AMOS. Cronbach's Alpha and corrected item-total correlations were employed to test reliability. Kaiser-Meyer-Olkin and Bartlett's tests were used to examine factorability. Model fit was examined by CMIN/DF, RMSEA, RMR, GFI, AGFI, CFI, and TLI (Hu & Bentler, 1999; Kline, 1998). Standardised factor loadings, Composite Reliability (CR) and Average Variance Extracted (AVE) were employed to test for convergent validity, and discriminant validity was verified using the Fornell-Larcker criterion and HTMT. A model-fitting criterion was employed in place of a hypothesis for assessment. H1-H5 were direct structural relationships, and H6 and H7 were the two hypothesized indirect effects via enterprise digital behaviour.

Based on the results of the survey, five academic experts and five experienced manufacturing managers (general managers, technical and financial directors, operations directors, etc.) were selected as interviewees for semi-structured interviews. The interviews lasted about 60-90 minutes, and with the participants' consent, they were recorded; then, following the familiarisation, initial coding, theme development, review, definition, and reporting stages (Braun & Clarke, 2006), the transcripts were coded and thematically analysed. Qualitative evidence was not used to provide an independent causal test; instead, it was employed to explore the reasons for the statistical results.

The two steps of the traditional quantitative analysis for structural equation modelling (Gerbing et al., 1988) were implemented. First, the measurement model was assessed to evaluate the coverage of the observed variables for the intended latent constructs and confirm their good reliability and factor structure. Only after the measurement evidence was deemed acceptable was the structural model used to test the hypothesis estimated. Therefore, before measuring the quality of the structure, these structural coefficients cannot be used. Descriptive statistics were used to explore the distribution of the data and learn more about the level of each construct.

Employ 5,000 bootstrap resamples to obtain bias-corrected 95% confidence intervals for mediation. H6 and H7 were considered supported because the confidence interval of the corresponding indirect effect excluded zero. The presence of a substantial direct effect and an indirect effect can be regarded as complementary partial mediation (Zhao et al., 2010). Direct-path reporting contained unstandardized coefficients, standard errors, standardised coefficients, critical ratios, and p-values. In addition to the procedural protection of time delay, a statistical test for common-method bias was carried out using Harman's single-factor diagnostic and a marker-variable assessment.

Due to the limited number of qualitative cases, both theory and practice were included. As shown in Table III, scholars have studied the definitions of constructs, mediation logic, and policy mechanisms, and manufacturing managers have described how cognition and policy support were turned into specific digital behaviours. With permission, interviews lasting about 60-90 minute interviews were conducted and recorded, transcribed within 48 hours, and anonymised.

Table III
Qualitative participant profile

Participant group	*n*	Profile	Role in qualitative explanation
Academic experts (A–E)	5	Management, digital transformation, innovation, and policy expertise	Reviewed construct logic, mediation, policy mechanisms, and sample coverage
Manufacturing managers (F–J)	5	General, technical, financial, and operations management across electronic equipment, machinery, pharmaceuticals, private and foreign-funded firms	Explained digital investment, implementation, innovation outcomes, and policy experience

Ethical Procedure. Before each interview, the participants were informed of the purpose of the study, confidentiality and anonymity, recording, and voluntary participation. Audio recording proceeded only with participant consent. The study records available for this paper did not include an official institutional approval number; therefore, no such approval number has been obtained.

Results

Measurement quality

The collected data supported the structure model presented in the above table; furthermore, an increase in convergent validity did not need to be assumed. Cronbach's alpha coefficients of the construct dimensions were between 0.817 and 0.832, and corrected item-total correlations were between 0.405 and 0.599. The value of the Kaiser-Meyer-Olkin was 0.873, and Bartlett's test was significant (χ^2 = 1391.542, df = 66, p < 0.001). The normalised factor loadings are 0.590 and 0.730. The CR values were 0.679 and 0.744, and both EDC (0.697) and PI (0.679) were slightly less than 0.70. AVE values were 0.407 and 0.491, and neither reached 0.50. Therefore, based on the reliability, factor-loading, model-fit, and discriminant-validity data presented below, convergent validity is assessed.

Exploratory factor analysis shows that the four factors have eigenvalues greater than 1. The first unrotated factor accounted for 0.3630 of the variance, and together the first four factors accounted for a variance of 0.6476. Figure 2 is the scree plot. The first drop in the curve occurs after the first factor, and the following drops are smaller; thus, only the first four factors, EDC, PI, EDB, and EIP, are selected. The 36.30% of the variance explained by the first factor is also due to common-method bias, and no single factor stands out in the covariance structure.

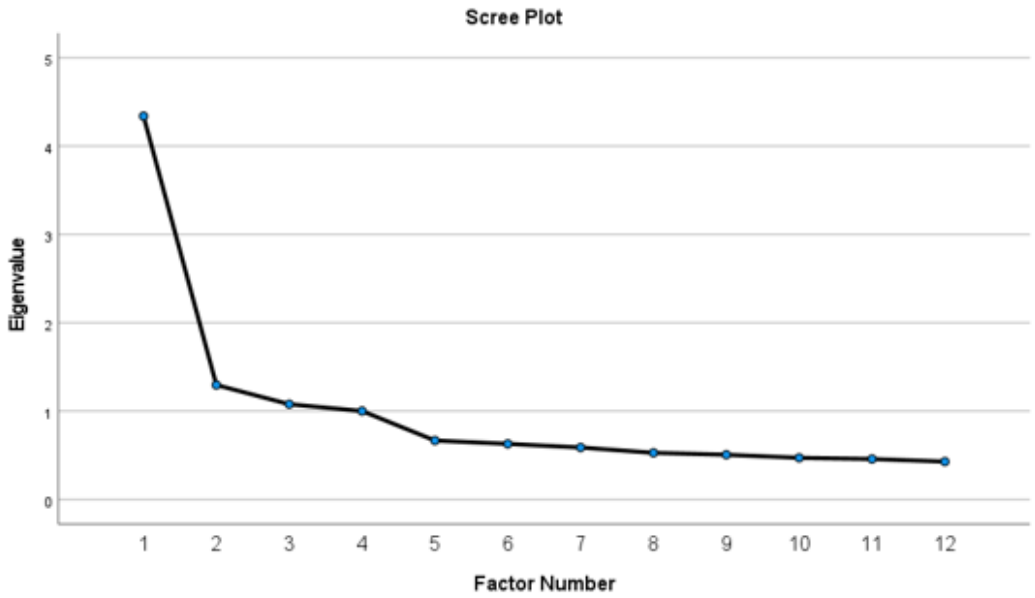

Fig. 2 *Scree plot for the exploratory factor analysis*

The confirmatory factor analysis showed a good fit: CMIN/DF = 0.670, RMSEA = 0.010, RMR = 0.007, GFI = 0.988, AGFI = 0.980, CFI = 1.000, and TLI = 1.016. A TLI slightly above 1 can be a sampling artifact of a very well-fitting model and is conventionally taken as 1.00. Two complementary tests of discriminant validity were employed. According to the Fornell-Larcker criterion, the square root of AVE for each construct (EDC = 0.659, PI = 0.638, EDB = 0.671, EIP = 0.701) was greater than its correlation with other constructs. The HTMT ratios were 0.469 - 0.628, and all of them were less than 0.85. Based on the results above, the four constructs are empirically different and have relatively low AVE values.

The two procedural and statistical safeguards against common-method bias were applied. The two-wave design separated the measurement of EDC and PI from the measurement of EDB and EIP. Based on Harman's single-factor diagnostic, the first unrotated factor explained 36.30% of the variance. The indicator variable is weakly positively correlated with EDC, PI, EDB, and EIP (r = 0.042 - 0.051). After correcting for the markers, the substantive correlations retained the same signs and were close to the uncorrected values. In short, the above tests do not indicate a serious problem of common-method bias that can explain the observed correlation; however, common-source bias has not been entirely ruled out.

Structural model and hypothesis tests

All three types of tests for the model structure showed good results. As shown in Table IV, the values of CMIN/DF, RMSEA, RMR, GFI, AGFI, CFI, and TLI were 1.728, 0.041, 0.025, 0.969, 0.951, 0.973, and 0.964, respectively. The above are the structural paths for the model. Figure 3 shows

the estimated structural equation model. Keep the figure as is, show the five direct paths among EDC, PI, EDB, and EIP visually, and present the measurement structure; the formal significance tests are provided in the tables below.

Table IV
Structural model fit indices

Index	Recommended criterion	Observed value	Evaluation
CMIN/DF	< 3.00	1.728	Acceptable
RMSEA	< 0.08	0.041	Good
RMR	< 0.05	0.025	Good
GFI	> 0.90	0.969	Good
AGFI	> 0.90	0.951	Good
CFI	> 0.90	0.973	Good
TLI	> 0.90	0.964	Good
Hoelter	> 200	337	Adequate

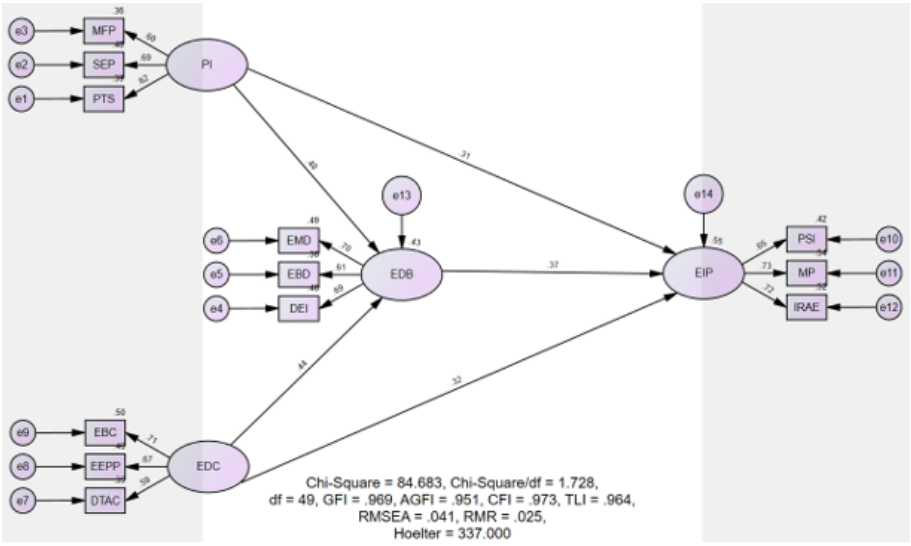

Fig. 3 *Estimated structural equation model*

All five direct paths were positive and statistically significant. EDC positively affected EIP (B = 0.302, SE = 0.046, *β* = 0.318, C.R. = 6.565, p < 0.001) and EDB (B = 0.428, SE = 0.048, *β* = 0.440, C.R. = 8.917, *p* < 0.001), thus supporting H1 and H2. EDB positively correlated with EIP (B = 0.364, SE = 0.047, *β* = 0.371, C.R. = 7.745, *p* < 0.001) and supported H3. PI positively correlated with EDB (B = 0.472, SE = 0.049, *β* = 0.481, C.R. = 9.633, *p* < 0.001) and EIP (B = 0.298, SE = 0.047, *β* = 0.307, C.R. = 6.340, *p* < 0.001), thus validating H4 and H5. Table V shows standardised effect decomposition, and Table V presents all the inferential statistics for the direct paths.

Table V
Standardized direct, indirect, and total effects

Relationship	Direct effect	Indirect effect	Total effect	Decision
EDC → EIP	0.318	0.163 via EDB	0.482	H1 supported
EDC → EDB	0.440	—	0.440	H2 supported
EDB → EIP	0.371	—	0.371	H3 supported
PI → EDB	0.481	—	0.481	H4 supported
PI → EIP	0.307	0.178 via EDB	0.485	H5 supported

Bootstrap analysis supports the inference of a mediation path. For H6, the standardised indirect effect of EDC on EIP via EDB was 0.163 (Boot SE = 0.024), with a bias-corrected 95% confidence interval of [0.119, 0.214] and p < 0.001. For H7, the standardised indirect effect of PI on EIP through EDB was 0.178 (Boot SE = 0.026), with a bias-corrected 95% confidence interval of [0.130, 0.232] and *p* < 0.001. Neither confidence interval included 0. As shown in Table 5, EDB still had a positive and significant direct effect in both paths. The total standardised effect of EDC is 0.482 when using three-decimal place reporting; the apparent arithmetic discrepancy from adding the displayed rounded components results from rounding of the underlying estimates. Table V shows the results of bootstrap mediation, and Table VI lists all hypothesis decisions.

Table VI
Summary of hypothesis testing

Hypothesis	Proposed relationship	Result
H1	EDC positively affects EIP.	Supported
H2	EDC positively affects EDB.	Supported
H3	EDB positively affects EIP.	Supported
H4	PI positively affects EDB.	Supported
H5	PI positively affects EIP.	Supported
H6	EDB mediates the EDC–EIP relationship.	Supported (partial)
H7	EDB mediates the PI–EIP relationship.	Supported (partial)

Qualitative triangulation

Table VI shows the four qualitative themes, how they are related to the mechanisms, examples of interview materials, and their connections with the quantitative path. Table separates academic experts (A-E) from manufacturing managers (F-J), and the manager-specific quotations and examples are taken from the manufacturing-manager subgroup.

Table VII
Qualitative themes and integration with the quantitative model

Theme	Mechanism	Representative interview evidence	Integrated inference
Cognitive framing and strategic authorization	Executives interpret digital benefits and authorize resources.	Manager F: digital-twin adoption followed recognition of its benefits.	EDC → EDB; EDC → EIP
Policy support as resource relief and validation	Policy reduces cost and uncertainty and signals legitimacy.	Manager H: a subsidy covering 40% of equipment costs enabled digital logistics.	PI → EDB; PI → EIP
Behavioral conversion through reconfiguration	Firms digitize R&D, logistics, customer management, and ecosystem coordination.	Manager G: digitized R&D reduced development time by 30%; Manager I reported faster personalized-product launches.	EDB as mediator; EDB → EIP
Innovation realization and feedback	Innovation outcomes reinforce transformation commitment and update executive judgment.	Experts and managers agreed that cognition alone was insufficient without implementation.	Partial mediation and future feedback loop

Innovation realization and feedback Innovation outcomes reinforce transformation commitment and update executive judgment. Experts and managers agreed that cognition alone was insufficient without implementation. Partial mediation and future feedback loop.

Theme 4, innovation realisation and feedback, shows that the performance results increased the desire for further changes. Interviews also showed some mediation: top management advanced innovation by means of talent, governance and portfolio selection outside the scope of measured digital behaviour, and policy incentives directly impacted R&D investment and commercialisation. Table VII is the consolidated presentation of themes, representative evidence and quantitative paths.

Theme 3: Behavioural conversion through organisational reconfiguration shows that digitalisation of R&D, customer management, logistics and ecosystem coordination are the links where cognition and support become visible actions. Manager G connected digitised R&D with a 30% reduction in product-development time, and Manager I explained how digitised customer management allowed for rapid personalised-product releases. The above observations provide process-level support for EDB as a mediator and for the positive EDB-EIP relationship.

Theme 1, Cognitive Framing and Strategic Authorisation, explains how executives' perception of digital value authorised investment. Manager F reported that the decision to adopt digital-twin technology followed the management's recognition of its operational advantages. Theme 2: Policy support as resource relief and institutional validation. Manager H's enterprise implemented digital logistics by using a subsidy to cover 40% of the cost of digital equipment. These accounts explain the positive EDC-EDB and PI-EDB paths.

A qualitative stage was added to present the application of the statistically derived relationships in an organisation. Six-step thematic analysis involved transcript familiarization, initial coding, category development, theme review, theme definition, and integrated reporting. Uniform comparison of academic and management data separated recurring mechanisms from firm-specific incidents. The final interviews added to the existing categories without introducing a new central mechanism and thus provided supporting evidence for the goals of explanation.

Discussion

Interpretation of the findings

Based on the above results, the innovation performance of enterprises is affected by both internal management cognition and external policy support, and a significant part of this effect is transmitted through organisational behaviour. The positive impact of executives' digital cognition on innovation performance supports upper-echelons theory, and executive interpretations are manifested in strategic choices and organisational results. Digital cognition can help leader's link technology investment to improved productivity, new markets, and organizational changes. Therefore, the upper-echelon reasoning system may need to incorporate technology-unstable cognitive functions to address the new problems posed by technological changes.

EDC-EDB is the link that connects managerial cognition to the organisation. Executives who anticipate benefits, are under external pressure, and require adaptation are more likely to support management digitalisation, business-process digitalisation and ecosystem integration. Therefore, digital transformation needs to be driven by strategic renewal rather than simply implementing new technologies (Warner & Wäger, 2019). Cognition offers a common logic for project selection and conflict resolution among budget, authority and routine.

Policy incentives had the strongest direct effect on the digitalisation of enterprises. In a manufacturing environment, this is feasible because the digital-to-physical transformation of industrial systems requires significant supplementary investment. Policy support lowers the cost of entry and provides technical knowledge to reduce the uncertainty of standards and market direction. As a result, stakeholder theory has started to attribute the impact of government intervention to corporate behaviour rather than external environmental forces. It is also a specific financial indicator of policy, and the four dimensions of the observed construct are as follows: technical, service, environmental and market-facilitating.

Enterprise digital behaviour directly improved innovation performance and partially mediated the antecedents. This is the research's main result. Executive awareness and policy availability are enabling conditions, but they are not sufficient on their own. Digitisation of management improves transparency and quality of decision-making; digitalisation of business speeds up experimentation and production feedback; ecosystem integration expands access to external knowledge and auxiliary resources. Together, these behaviours provide the organisational infrastructure for cognition and support to become product, market and resource-allocation outcomes.

Partial mediation is theoretically informative rather than full mediation. Besides digital-behavioural indices, other ways for executives to promote innovation include strategic cooperation, culture construction, talent selection and resource allocation. Policy incentives may directly fund R&D, strengthen market demand and open procurement opportunities. Therefore, given the presence of both direct and indirect effects, a single-channel model is not appropriate. It can also be seen that enterprises that receive the same policy support have different innovation results due to varying managerial awareness and organisational execution of external resource utilisation.

Compare the standardised total effects for more detail. Policy incentives had a total effect of 0.485 on innovation performance, and executives' digital cognition also had a total effect of almost the same, 0.482. They are the same; therefore, they cannot be the cause. Policy incentives had a stronger path to digital behaviour (0.481 vs. 0.440), and executives' cognition had a slightly stronger direct effect on innovation performance (0.318 vs. 0.307). Thus, it can be seen that the demand for external support is at the level of implementation, and executive cognition also drives innovation through strategic paths away from measured digital practices.

The direct effect of enterprise digital behaviour on innovation performance (0.371) was greater than either direct antecedent effect. Therefore, the author believes that organisational behaviour is the proximate cause of performance. Cognitive commitment without implementation is merely a wish; policy support without execution is a wasted or poorly utilised resource. Therefore, it cannot be concluded that the behaviour is unrelated to leadership or policy; it may simply be that their contributions are concentrated in the organizational practice near the area of innovation creation.

Relatively small means for the construct dimensions, generally around 3.46-3.54 on a five-point scale, are also worth noting. Respondents did not consider their enterprises to be fully transformed or highly innovative. Therefore, the results may be due to the significant differences among the firms at various stages, rather than a ceiling-level sample. This finding is consistent with the ongoing problem of how to move from local digital projects to full-scale transformation of management, operations and external ecosystems.

Relationship to prior digital transformation research

Recently, some research has shown that executive functions are not always beneficial. Lyu et al. (2025) identified a nonlinear equity-incentive relationship under conditions of performance expectations and competition; Cao and Wu (2025) have focused on CEO-TMT cognitive complementarity and executive incentives in value creation by digital innovation strategy. Chen and Sui (2025), D. Li et al. (2025) and Cui and Meng (2025) have also found that performance feedback, slack, CEO power and TMT heterogeneity affect the decision to transform. Our model does not account for such circumstances, and based on the interview data, a positive average effect can be achieved under all circumstances because firms only create value when it is turned into consistent digital behaviour.

The results further support the existence of executive digital human capital. Cao and Wu (2025) associate executives' IT backgrounds with attention, reduced managerial myopia, and digital technology innovation; Yin et al. (2025) link CEO digital embeddedness to TMT creativity and entrepreneurial agility. This paper does not obtain digital cognition from context or network embedding; instead, it studies the contents of digital

cognition directly. Wu and Shi (2025) findings that digitalisation strengthens green cognition for renewable-energy innovation also indicate a feedback mechanism. In line with the qualitative theme of innovation realisation and feedback, the following long-term studies will determine whether previous digital behaviour and innovation performance impact executive cognition.

The qualitative mechanisms are in line with the latest executive studies. Zhu et al. (2025) have identified several pathways for the influence of top management on innovation, and the current interviews offer contextual support for the attention-authorization-coordination-resource allocation system in manufacturing digitalisation. Ma and Wei (2025) position capability reconstruction between executive cognition and digital green innovation performance. Our theme of behaviour-to-conversion is in line with this mediation logic, but we extend the intervening process from capability reconstruction to management digitalisation, business digitalisation and ecosystem integration.

Therefore, according to the above results, digital transformation should be regarded as organisational change rather than a technical event. Vial (2021) thinks that digital technology will promote strategic responses and structural changes, and Verhoef et al. (2021) differentiate between transformation and narrow digitisation activities. The above results provide a way to realise the general ideas. Executive cognition and policy incentives explain why transformation attracts attention and resources; enterprise digital behaviour shows how the transformation is implemented; innovation performance is one of the results.

The results also support dynamic-capability research. Detection is the recognition of digital opportunities and risks in top management's anticipation of benefits and environmental pressures. Seizing refers to allocating resources and choosing reform initiatives based on policy support. Transformation refers to altering routines, processes and ecosystem connections to change behaviour in enterprises (Teece, 2007; Warner & Wäger, 2019). Although the study does not directly observe the three stages of dynamic capability, the pattern is consistent with a microfoundational explanation of digital renewal.

Finally, the results meet the conditions for research treating government support as a general innovation input. Therefore, the effectiveness of the policy will also depend on implementation at the organizational level. The policy may sound good, but in the absence of top-down leadership, project management, professional talent and an all-round system, it will not achieve its goals. At the same time, specific technical and market support can be provided to solve the bottleneck of implementation. Therefore, policy evaluation should also consider the differences in programme design and firm response.

Theoretical implications

First, the theoretical contribution of this study is integration and specification rather than the construction of a new cognition-behaviour-performance mechanism. According to top-level executive theory, it is due to the discretion of top management; strategic cognition explains how to identify digital opportunities and adapt to changes, and according to stakeholder theory, policy support provides resources and institutional signals. All the reasons mentioned above have been combined into a single model to show how internal managerial interpretation and external institutional support work together in the process of digital transformation.

Second, the study takes enterprise digital behaviour as the organisational transformation mechanism that connects the antecedent conditions with innovation results. Therefore, to reduce the explanatory gap between favourable executive cognition/policy support and actual performance, managerial digitalisation, business digitalisation and ecosystem integration have been identified as observable forms of implementation. The bootstrap results also support this conclusion; as both the indirect effects of EDC and PI are significant, coefficient decomposition is not required.

Third, research on policy incentives is generally not directly linked to behavioural changes. Policy support is directly and indirectly related to innovation performance via EDB. This pattern suggests that the impact of policy incentives cannot be observed merely by looking at the nominal availability of subsidies, services and market-facilitation measures; rather, some of their association with innovation is realised through organisational implementation.

Fourth, the model provides a cross-level link between executive cognition and organisational performance. Positioning EDB as a mediator links EDC and EIP at a meso-level to provide a path for an executive-level cognitive construct to affect firm-level innovation outcomes; the remaining direct effect is attributed to governance, talent, alliance, and resource-allocation mechanisms outside the scope of measured digital behaviour.

Finally, the parallel arrangement of EDC and PI suggests cooperation rather than an unknown effect. Currently, this study does not attribute the increase in policy incentives to cognition or otherwise. Therefore, they are both independently related to EDB and EIP, and both have significant behaviourally transmitted parts. Future research will investigate the reasons for the results mentioned above in terms of explicit interaction, substitution effect or boundary condition.

Practical implications

According to the results, manufacturing executives need to build a sense of digital cognition in their teams. Training should connect technology with the business model logic and operating processes in relation to risk and organisational changes, not focus solely on technical terms. The top management office should establish an all-digitalisation portfolio in support of the goals of innovation, designate a process owner to be responsible for this work, specify required abilities, and set practical behavioural indicators. Thus, the risk of isolated or departmentalisation of digital investments is reduced.

The first priority is the behaviour change desired by the company. Do not rely solely on investment amount or the number of installed systems to measure change. Other practical indicators include the proportion of decisions supported by integrated data, cycle-time reduction in R&D and production, cross-functional process integration, supplier/customer connectivity, and the reuse of digital knowledge across projects. Connect the behavioural indicators to innovation results via a governance mechanism.

Different combinations of financial and non-financial support are more suitable for policymakers than general subsidies. Small- or less-digitally-mature enterprises may require diagnostic services, shared facilities, training and implementation support in addition to finance. Older enterprises can take advantage of standards, interoperability programmes, industrial platforms, demonstration areas and ecosystem construction. Programme evaluation should monitor additionality and implementation behaviour to reduce the risk of subsidy-induced private investment without altering organisational practices.

Research boundaries and directions for further testing

Several limitations should be considered when interpreting the findings. Firstly, the design of the model is relatively simple and does not list all the resources required for digitalisation. The quality of data, legacy-system compatibility, employee skills, cybersecurity governance, absorptive capacity and financial slack may affect whether cognition and policy support result in behaviour change. Their absence does not mean that the only form of conversion for corporate digital behaviour is otherwise. Future models will differentiate between behavioural activation and the technological-human capacity for implementation quality.

Second, there is a time delay in the two-wave design, but causality has not been established. EDC and PI were measured before EDB and EIP, and a reverse relationship is also possible. Successful innovation will boost the executives' digital confidence and provide funding for the transformation through policy programmes. Using objective event data, such as policy awards, system implementation dates, patent applications, and new-product launches, a repeat-wave or cross-lagged model can be established to improve temporal inference.

Third, the research is based on management reports from Chinese manufacturing enterprises. Harman's and the marker-variable diagnostics reduce the problem of common-method bias in the results, but they cannot eliminate common-source variance. A relatively low AVE does not indicate good convergent validity; therefore, other types of measurement evidence need to be employed, such as reliability, model fit, Fornell-Larcker results and HTMT ratios. In the future, a model with archival indices, multiple respondents per firm, and samples from the service sector and other institutional environments will be applied. Currently, the bootstrap confidence intervals support the two indirect effects, but extended longitudinal data are still needed to investigate the reciprocal relationship between cognition, digital behaviour and innovation.

Conclusion

This paper studies the impact of executives' digital cognition and policy incentives on enterprise innovation performance through enterprise digital behaviour in Chinese manufacturing enterprises. Based on the results, there is a cognition-support-behaviour-performance sequence: EDC and PI are positively correlated with EDB and EIP; EDB is positively correlated with EIP; and the 5,000-resample bias-corrected bootstrap tests indicate significant indirect effects for both EDC → EDB → EIP and PI → EDB → EIP. As a result, the direct effects of both antecedents were still significant, and EDB acted as a partial mediator.

There are some deficiencies in this research. Although temporal separation and statistical common-method diagnostics have reduced the problem of same-occasion response bias, the data are non-experimental and largely based on managerial judgment. Care should be taken to ensure the validity of convergence; however, as all factor loadings, reliability evidence, discriminant validity tests and the overall model fit were supported, this problem did not affect the results. The sample consists only of Chinese manufacturing enterprises and does not include other sectors or institutions. In the future, a longitudinal design, objective innovation and digital-investment indicators, multiple respondents per firm, and cross-context replication may be employed.

There are still some limitations in this study; thus, the relationship between top-level interpretation, policy support and innovation results has not been fully explored. It has not introduced a new cognition-behaviour-performance sequence; instead, it is a combination of the specification and empirical verification of two existing antecedent domains plus an observable organisational conversion mechanism. The results show that the impact of digital opportunities and policy support is greatest when they can be realised through integrated management, business and ecosystem digitalisation.

Conflict of Interest

The authors declare that there is no conflict of interest.

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