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Organizational DNA as a Governance Execution Capability for Academic Sustainability and the Sustainable Development Goals in Egyptian Higher Education

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Organizational DNA as a Governance Execution Capability for Academic Sustainability and the Sustainable Development Goals in Egyptian Higher Education

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Abstract

Universities are expected to advance the Sustainable Development Goals (SDGs), particularly quality education (SDG 4), decent work (SDG 8) and effective, accountable institutions (SDG 16), yet these commitments depend on internal governance arrangements that can sustain academic renewal under changing conditions. This explanatory sequential mixed-methods study examined associations between four organizational DNA (ODNA) dimensions—decision rights, information flow, motivators and structure—and perceived Academic Sustainability, comprising institutional resilience, knowledge continuity and employability sustainability. Survey responses from 532 academic staff across three Egyptian universities were analysed using group comparisons, hierarchical regression, confirmatory factor analysis and structural equation modelling. Four negatively worded items were excluded following reverse-scoring diagnostics, leaving 20 ODNA and 15 sustainability items. The four ODNA dimensions increased explained variance in perceived Academic Sustainability by 55 percentage points (total $R^2 = .657$); information flow showed the largest standardized regression coefficient ($\beta = .30$). A higher-order model with controls fitted well (CFI = .993, RMSEA = .018, SRMR = .036). Differences across the three universities were substantial, while faculty type, rank and administrative position showed no significant multivariate differences. Interviews with 25 senior leaders contextualized the findings through information credibility, centralization, incentives and procedural constraints. Common-method variance and the one-university-per-regime sampling design limit causal interpretation and generalizability. The findings suggest that credible information systems and bounded delegation are promising governance priorities for academic continuity and adaptability, and that strengthening this institutional execution capacity offers a practical pathway through which universities can sustain their contribution to SDG 4, SDG 8 and SDG 16.

Keywords: Organizational DNA; academic sustainability; higher education governance; information flow; decision rights; mixed methods; Egypt; Sustainable Development Goals; quality education

Introduction

Universities are increasingly asked to help societies navigate ecological disruption, technological acceleration, labour-market volatility and the transition toward sustainability-oriented economies. Meeting that expectation requires more than adding sustainability topics to curricula: it requires institutions that can renew knowledge, adapt programmes, align learning with future skills and continue functioning under unstable policy and resource conditions (Abo-Khalil, 2024; Leal Filho et al., 2023). The 2030 Agenda for Sustainable Development positions universities as key actors in this transition, not only through the education and research they provide but also as institutions that must themselves be effective, accountable and inclusive (SDSN Australia/Pacific, 2017; United Nations, 2015).

The central problem addressed here is an *execution gap*. Higher education institutions frequently adopt sustainability strategies, Sustainable Development Goal (SDG) commitments, digital-transformation plans or employability agendas, yet these commitments often remain fragmented across units and short-lived initiatives (Adams et al., 2018; Holst et al., 2025). The question is

therefore not only *what* universities should teach, but *how* their internal governance allows them to decide, coordinate, learn, reward and adapt so that renewal becomes operational.

This execution gap has direct consequences for the SDGs. SDG 4 calls for equal access to quality tertiary education (Target 4.3) and for a substantial increase in the number of youth and adults with relevant skills for employment and decent work (Target 4.4); SDG 8 seeks to reduce the proportion of young people not in employment, education or training (Target 8.6); and SDG 16 calls for effective, accountable and transparent institutions (Target 16.6) and responsive, inclusive and participatory decision-making at all levels (Target 16.7) (United Nations, 2015). Universities can deliver on the first two only if their own governance reflects the third: the capacity to renew curricula, sustain research and keep graduates employable rests on how authority, information, incentives and coordination are organized inside the institution. In Egypt, where the national sustainable development strategy assigns higher education a central role in human capital development and institutional modernization (Ministry of Planning, Monitoring and Administrative Reform, 2016), this link between internal governance and SDG delivery is particularly salient. Governance has likewise been identified as a decisive yet under-examined condition for SDG implementation in higher education worldwide (Leal Filho et al., 2023).

Organizational DNA (ODNA) offers a governance-execution lens for this problem. Originating in strategy-execution research, ODNA describes the internal design code through which organizations distribute decision rights, circulate information, align motivators and configure structures (Neilson et al., 2008). Applied to higher education, the framework directs attention to whether curriculum renewal, research continuity, digital integration and employability reform can actually be implemented (Christensen & Eyring, 2011). Recent work shows that governance capability and institutional structure are linked to university responsiveness (Luo et al., 2024), and that sustainability depends on culture, routines and whole-institution embedding (Abo-Khalil, 2024; Holst et al., 2025; Leal Filho et al., 2023). Nonetheless, the relationship between internal governance design and the academic capabilities on which sustainability depends remains insufficiently tested with validated measures.

This study addresses that gap by conceptualizing *Academic Sustainability* as a multidimensional, perceived institutional capability comprising Institutional Resilience (sustaining academic functioning under disruption), Knowledge Continuity (research vitality, mentoring, institutional memory and renewal) and Employability Sustainability (the durability of graduate relevance through curriculum responsiveness, future-oriented skills and labour-market engagement). We note at the outset that the construct concerns the organizational capacity to sustain academic work; it does not measure environmental sustainability or sustainability-specific curricula, and we interpret it accordingly. Rather, Academic Sustainability captures the institutional and social dimensions of sustainable development: it operationalizes the organizational preconditions through which a university can contribute, over time, to SDG 4 (continuity and quality of education and future-oriented skills), SDG 8 (graduate employability and decent work) and SDG 16 (effective and accountable institutions).

Egyptian higher education provides a useful setting because universities operate under differentiated governance arrangements—public, private and national (*Ahliyya*) institutions—that differ in centralization, autonomy, infrastructure and labour-market orientation. To avoid institutional ranking, the study reports these as anonymized governance-regime profiles. The aim of the study is therefore to examine whether, and through which governance mechanisms,

internal organizational design supports the academic capabilities on which universities' contribution to the SDGs depends. The study asks:

1. How do ODNA and Academic Sustainability differ across the three anonymized governance-regime profiles?
2. To what extent do Decision Rights, Information Flow, Motivators and Structure predict Academic Sustainability and each of its dimensions (Institutional Resilience, Knowledge Continuity, Employability Sustainability), over and above contextual and individual controls?
3. Do ODNA and Academic Sustainability differ between STEM faculties and humanities and social science faculties?
4. Which governance mechanisms and feasible levers do senior academic leaders identify, and how do they help explain the quantitative pattern?

Literature Review

Organizational DNA and governance execution

Neilson et al. (2008) identify four building blocks of organizational DNA: Decision Rights, Information Flow, Motivators and Structure. Their argument is that strategy execution depends less on formal plans than on whether these elements jointly allow people to act. ODNA originated in practitioner-oriented strategy research rather than in a single academic theory; we therefore use it as an organizing framework whose dimensions overlap with established concepts of organizational design—allocation of authority, information processing, incentive alignment and coordination structure. Higher education reform literature has similarly described durable university renewal as changing institutional "DNA" from the inside out (Christensen & Eyring, 2011), and empirical studies have begun applying ODNA beyond corporate settings, linking it to institutional excellence in public universities (Al Khasabah, 2025) and to agility and sustainability in the Egyptian petroleum sector (Elsanhawy & Badway, 2023).

Decision Rights concern who may decide, at what level and within what boundaries. When authority is located close to relevant knowledge, organizations respond faster; excessive centralization delays action and weakens ownership. In universities, curriculum renewal, research resource allocation, partnerships and crisis response all require timely decisions at faculty, department or programme level.

Information Flow refers to the movement, credibility and usability of information across units and levels. It is a mechanism of institutional visibility and learning rather than communication volume. Universities produce knowledge yet often struggle to convert dispersed academic knowledge into shared organizational intelligence; fragmented reporting and performative documentation prevent institutions from learning from their own data. Sustainability governance research likewise emphasizes information infrastructures and reflexivity as conditions for implementing commitments (Glass & Newig, 2019; Leal Filho et al., 2023).

Motivators are the formal and informal incentives that direct behaviour. In universities they include promotion criteria, recognition, autonomy, research opportunity, mentoring and social impact. Where incentives reward narrow outputs while neglecting teaching quality, mentoring or institutional service, sustainability may remain symbolic.

Structure is the coordination architecture through which work is organized: committee systems, reporting lines, layers of approval, procurement procedures and cross-unit mechanisms. Structure can enable academic work or absorb institutional energy through bureaucracy; governance capability and structure are linked to universities' capacity to respond to changing demands (Luo et al., 2024).

Academic Sustainability as an institutional capability

Sustainability in higher education has expanded beyond campus greening to teaching, research, governance, culture and societal contribution, and it becomes meaningful only when embedded in the university's operating system (Adams et al., 2018; Holst et al., 2025). We define Academic Sustainability as the university's capacity to remain academically viable, adaptive, knowledge-renewing and socially relevant over time, reflected in three dimensions.

Institutional Resilience is the ability to maintain academic functioning and educational quality under disruption—pandemics, financial pressure, technological or regulatory change. *Knowledge Continuity* is the capacity to sustain, renew and transfer knowledge across time through research vitality, mentoring, institutional memory and succession; governance features such as participation, policy coherence, reflexivity and adaptation are associated with sustainability outcomes (Glass & Newig, 2019), and sustainability science in higher education depends on institutionalized collaboration (Yarime et al., 2012). *Employability Sustainability* is the capacity to keep graduates relevant through curriculum responsiveness, future-oriented skills, experiential learning, external engagement and graduate tracking (Akhtar et al., 2024; Scandurra et al., 2024).

Higher education governance and the Sustainable Development Goals

The 2030 Agenda frames sustainable development as an integrated set of economic, social, environmental and institutional goals (United Nations, 2015). Guidance for universities distinguishes four areas of SDG contribution—learning and teaching, research, operations and governance, and external leadership—and stresses that the first two depend on how the institution itself is governed (SDSN Australia/Pacific, 2017). Reviews of SDG implementation in higher education show that commitments often stall where governance is fragmented, responsibility is not clearly allocated and monitoring data are weak or unused (Leal Filho et al., 2023), and governance qualities such as participation, policy coherence, reflexivity and adaptation are associated with SDG progress more broadly (Glass & Newig, 2019). These conditions correspond closely to the four ODNA blocks: the allocation of decision rights, credible information flow, aligned motivators and coordinating structures.

Each dimension of Academic Sustainability can also be mapped onto specific SDG targets. *Institutional Resilience* protects the continuity of quality education under disruption (SDG 4, Target 4.3); *Knowledge Continuity* sustains the research, mentoring and capacity building on which knowledge for sustainable development depends (SDG 4 and SDG 9, Target 9.5 on enhancing scientific research); and *Employability Sustainability* links curricula to relevant skills

and decent work (Targets 4.4 and 8.6). Internal governance that is effective, transparent and participatory is itself an expression of SDG 16 (Targets 16.6 and 16.7). Framed in this way, ODNA describes the institutional machinery through which universities translate SDG commitments into durable academic practice.

Linking ODNA to Academic Sustainability

Universities may announce sustainability, digital or employability strategies, but these intentions become operational only when internal design enables academic and administrative actors to act. In systems characterized by centralization, regulatory density and uneven autonomy, universities may not lack aspirations; they may lack the execution architecture to convert aspirations into resilience, knowledge continuity and employability relevance. Despite growing research on sustainability culture, SDG implementation and governance (UNESCO IESALC, 2024), few studies have tested how the four design elements *jointly* relate to these capabilities with a validated measurement model and appropriate controls. This gap is especially relevant for universities in middle-income countries, where expectations that higher education will drive SDG progress are rising faster than internal governance reform.

Conceptual Model and Hypotheses

The model (Figure 1) treats the four ODNA blocks as correlated exogenous conditions and Academic Sustainability as a higher-order capability reflected in its three dimensions. The blocks are expected to be mutually reinforcing: delegated authority is unlikely to improve outcomes if information is unreliable, and streamlined structures may remain ineffective if authority is centralized (Neilson et al., 2008). Governance-regime profile, faculty type, academic rank and administrative position are modelled as controls.

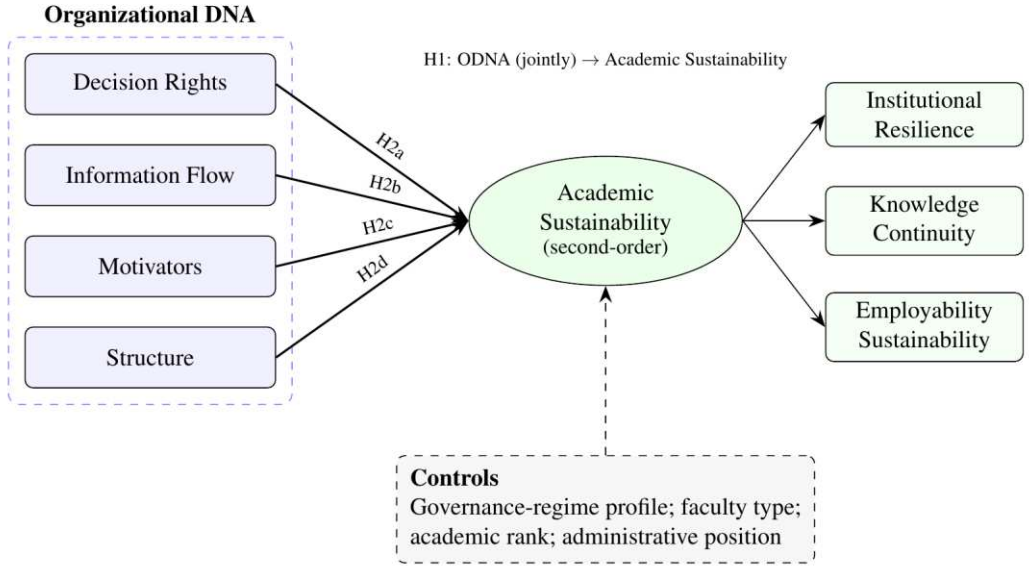


Figure 1. *Conceptual model. Double-headed covariances among the four ODNA blocks and between controls and ODNA are estimated but not drawn.*

ODNA, considered jointly, is positively associated with perceived Academic Sustainability.

Decision Rights (H2a), Information Flow (H2b), Motivators (H2c) and Structure (H2d) each make a unique positive contribution to perceived Academic Sustainability, net of the other blocks and the controls.

ODNA and Academic Sustainability differ between STEM faculties and humanities and social science faculties (non-directional, exploratory).

Method

Design

The study used an explanatory sequential mixed-methods design (Creswell & Plano Clark, 2018). The quantitative phase validated the measurement model and estimated associations and group differences; the qualitative phase examined how senior leaders interpret the governance mechanisms behind these patterns. The interview protocol (Appendix A) was developed from the ODNA framework before data collection. Interviews began after preliminary analysis of the survey. The original ODNA-based interview guide was retained, and follow-up probes were added to explore the emerging findings, including reporting credibility and structural friction.

Context and anonymization

Participants worked in three governance-regime profiles: Regime A (public-like; relatively higher procedural density and centralized decision routines), Regime B (private-like; relatively higher autonomy and employability orientation) and Regime C (national-like; relatively stronger infrastructure and digitalization associated with recent institutional development). Each regime represents one purposively selected university: one public university (A), one private university (B), and one national (Ahliyya) university (C). Maximum-variation purposive selection sought contrast in structural characteristics. Accordingly, university and regime are perfectly confounded: comparisons describe the three sampled campuses and cannot isolate governance regime effects or support inference to all universities of a given type. Campus-specific eligible-faculty population sizes were not established. Profiles are reported as anonymized governance-pattern contrasts, not institutional evaluations, and were entered as controls in all predictive models.

Participants and procedure

The analytic sample comprised 532 faculty members: Regime A, n = 298 (56.0%); Regime B, n = 154 (28.9%); Regime C, n = 80 (15.0%). By faculty type, 255 (47.9%) worked in humanities and social science faculties and 277 (52.1%) in STEM faculties. By rank, 287 (53.9%) were lecturers (assistant professors), 150 (28.2%) associate professors and 95 (17.9%) full professors. Most held no administrative post (n = 378, 71.1%); 100 (18.8%) were heads of department and 54 (10.2%) vice deans or deans. Faculty were recruited by convenience and snowball sampling through official departmental mailing/distribution lists and closed faculty WhatsApp groups. The Modern Standard Arabic questionnaire was administered using secure Google Forms links and paper copies delivered to faculty offices between 15 October 2025 and 10 January 2026. Of 710

reported invitations, 532 complete cases were retained (74.9% completed per reported invitation); because snowball circulation can extend beyond the documented invitation frame, this is a descriptive completion-to-invitation ratio rather than a probability-sample response rate. Online items were mandatory, and returned paper questionnaires were checked for completeness; the analytic file has no missing item values.

Data screening found no missing values, no duplicate response patterns, no respondents giving identical answers to all items, and no multivariate outliers (Mahalanobis distance, $p < .001$). Item skewness ranged from −0.33 to −0.02 and excess kurtosis from −0.51 to −0.06 (Appendix B), supporting maximum-likelihood estimation.

Measures

The instrument was developed specifically for this study by operationalizing the four building blocks of the ODNA framework (Neilson et al., 2008) and the three dimensions of Academic Sustainability. Initial item generation yielded a draft pool of 45 items across all dimensions. Content validity and item clarity were evaluated by a panel of five experts in higher education governance and organizational behavior. Based on panel feedback, items were refined for institutional relevance, leading to a 39-item instrument (24 ODNA items and 15 Academic Sustainability items). The instrument was drafted in English and translated into Modern Standard Arabic using translation and back-translation procedures (Brislin, 1970). An independent bilingual scholar translated the items into Arabic; a second bilingual scholar, unaware of the English original, back-translated them into English. Discrepancies were resolved through research-team consensus. A pilot involving 35 faculty members excluded from the main sample assessed face validity, item comprehension and feasibility of administration. Minor wording refinements were made before field deployment. Responses were recorded on a five-point agreement scale (1 = strongly disagree; 5 = strongly agree).

Organizational DNA was administered as 24 items, six per block, of which one per block was negatively worded (Appendix A). *Academic Sustainability* comprised 15 positively worded items, five per dimension. Higher scores indicate stronger perceived ODNA and higher perceived Academic Sustainability.

Item purification

Before any substantive analysis, the four negatively worded ODNA items (Q4, Q10, Q15, Q20) were examined after reverse-scoring (Table C1, Appendix C). They correlated near zero with the five positively worded items of their intended scales in the pooled sample ($r = −.03$ to $.08$) and negatively within each governance regime (mean $r = −.42$ to $−.49$), while correlating strongly with one another ($r \approx .86$) and with governance-regime membership ($\eta^2 = .56–.58$). Their inclusion lowered the internal consistency of every ODNA scale (e.g., Decision Rights $\alpha = .82$ with vs. .94 without). This pattern indicates that the items did not measure their intended dimensions and is consistent with a negative-wording method effect (Weijters et al., 2013); the reported verification of the original response forms did not identify a coding discrepancy. The investigators report checking the original paper and Google Forms records against Q4_R, Q10_R, Q15_R and Q20_R in the analysis file with a complete match; each was reversed exactly once using $6 − x$. These findings therefore favour a negative-wording method effect rather than a coding error. Because these four items failed to align with their intended dimensions, they were

excluded from all analyses, yielding the retained 20-item ODNA scale. The four items were therefore excluded from all analyses. Every composite, correlation, group comparison, regression, CFA and SEM reported below uses the same 20 ODNA and 15 Academic Sustainability items, each dimension being measured by five items.

Quantitative analysis

Analyses proceeded in five steps. (1) Descriptive statistics, Cronbach's α and Pearson correlations were computed for unweighted sum composites. (2) Differences across governance regimes (RQ1) were tested with Welch's ANOVA, ω^2 and Games–Howell contrasts, which do not assume equal variances or group sizes. (3) Group effects on the seven dimensions jointly (RQ1, RQ3) were tested with a main-effects MANOVA including regime, faculty type, rank and administrative position; interaction terms were not estimated because several higher-order cells contained fewer than five cases. (4) Predictive relationships (RQ2; H1–H2) were tested with hierarchical regression: controls at Step 1 (regime, faculty type, rank and administrative position as dummy variables) and the four ODNA blocks simultaneously at Step 2, for the total and for each dimension. Stepwise selection was not used because it capitalizes on chance and biases inference (Smith, 2018). HC3 heteroscedasticity-consistent standard errors were used (Hayes & Cai, 2007), and relative importance was assessed with general dominance weights. (5) Confirmatory factor analysis (CFA) and structural equation modelling (SEM) were estimated by maximum likelihood. Fit was judged with χ^2, CFI, TLI, RMSEA (90% CI) and SRMR (Hu & Bentler, 1999; Kline, 2016); reliability with α and composite reliability (CR); convergent validity with AVE; and discriminant validity with the Fornell–Larcker criterion (Fornell & Larcker, 1981) and the heterotrait–monotrait ratio (HTMT < .85; Henseler et al., 2015). Common-method variance was examined with a single-factor CFA and an unmeasured latent method construct (Podsakoff et al., 2003). The higher-order structural model was estimated without (M4) and with (M5) the control variables.

Analyses were conducted in Python 3.13 (pandas; SciPy 1.18; statsmodels 0.15). CFA and SEM models were estimated with a maximum-likelihood routine in reticular action model specification, which reproduced the AMOS estimates for the original measurement and structural models to the third decimal (e.g., $\chi^2 = 505.198$ and 537.335).

Qualitative phase

Semi-structured interviews were conducted with 25 senior academic leaders—deans, vice deans, heads of department, quality-assurance leaders and other administrators with direct governance responsibility. The guide (Appendix A) covered decision rights, information credibility, motivators, structural constraints, resilience, knowledge continuity, employability and the governance norms leaders would change if they could. Interviewees were purposively selected for senior roles with direct experience of university governance: 9 were from A, 9 from B and 7 from C. The 25 deans, vice deans and department heads were interviewed face-to-face or via Zoom in Arabic, with consent-based audio recording and verbatim transcription. Sessions lasted 35–70 minutes (median 48). Quotations were translated into English by the research team and checked for semantic equivalence.

Data were analysed thematically (Braun & Clarke, 2006) using deductive codes derived from the ODNA framework and inductive codes for emergent mechanisms. Themes were refined through

analytic memos, negative-case checking and an audit trail. Two independent researchers coded transcripts in NVivo; disagreements were discussed with a third senior researcher until consensus was reached. The research team reports Cohen's κ = .88 for intercoder agreement. Interpretive orientations were developed iteratively from the thematic audit trail and were not used as mutually exclusive participant classes. Prevalence is reported as the number of interviews in which a theme appeared, to indicate salience rather than population frequency.

Integration

Integration occurred at the interpretation stage using a joint display that aligns each quantitative finding with the qualitative mechanism that elaborates, confirms or diverges from it (Fetters et al., 2013).

Ethics

The study received prior approval from Research Ethics Committee of the Faculty of Education, Beni-Suef University (Ref. BSU-EDU/REI-2025-0812), covering both phases. Participation was voluntary; written informed consent was obtained; participants were informed of confidentiality and withdrawal rights; and data were stored securely and reported in anonymized, aggregated or coded form.

Results

Descriptive statistics and correlations

Table 1 reports descriptive statistics for the purified composites. Mean scores per item were slightly above the scale midpoint (3.28–3.67 across scales), distributions were close to symmetric, and internal consistency was high (α = .92–.95).

Table 1. *Descriptive statistics and internal consistency of the purified composites (N = 532)*

Scale	Items	Observed range	*M*	*SD*	*M*/item	Skew	Kurtosis	α
Organizational DNA (total)	20	28–97	66.66	13.36	3.33	−0.07	−0.34	.95
Decision Rights	5	5–25	16.58	3.96	3.32	−0.07	−0.33	.94
Information Flow	5	5–25	16.63	4.04	3.33	−0.15	−0.33	.94
Motivators	5	5–25	17.08	4.24	3.42	−0.11	−0.31	.94
Structure	5	5–25	16.37	4.22	3.27	−0.15	−0.32	.95
Academic Sustainability (total)	15	25–75	52.56	9.65	3.50	−0.17	−0.28	.93
Institutional Resilience	5	5–25	18.34	3.66	3.67	−0.29	−0.12	.92
Knowledge Continuity	5	5–25	16.87	4.01	3.37	−0.16	−0.42	.94
Employability Sustainability	5	5–25	17.35	4.23	3.47	−0.21	−0.26	.95

Note. Composites are unweighted sums of the retained items (possible range 5–25 per dimension; 20–100 for ODNA; 15–75 for Academic Sustainability). The four negatively worded ODNA items were excluded from every composite (see Section 4.5 and Appendix C). *M*/item = mean on the original 1–5 metric. Kurtosis is excess kurtosis.

ODNA blocks were moderately to strongly intercorrelated (r = .52–.58; Table 2), consistent with their conceptualization as interdependent elements of one design system. Each block correlated positively with every Academic Sustainability dimension (r = .46–.62) and with the Academic Sustainability total (r = .64–.68); the ODNA total correlated r = .80 with the Academic Sustainability total, supporting H1 at the bivariate level.

Table 2. *Pearson correlations among the purified composites (N = 532)*

Variable	1	2	3	4	5	6	7	8	9
1. Decision Rights	—								
2. Information Flow	.57	—							
3. Motivators	.53	.56	—						
4. Structure	.53	.56	.52	—					
5. ODNA total	.81	.83	.81	.81	—				
6. Institutional Resilience	.50	.50	.46	.51	.61	—			
7. Knowledge Continuity	.51	.53	.48	.51	.62	.53	—		
8. Employability Sustainability	.58	.61	.60	.54	.72	.44	.49	—	
9. Academic Sustainability total	.65	.68	.64	.64	.80	.79	.83	.81	—

Note. All correlations are significant at $p < .001$ (two-tailed). Correlations between a dimension and the total that contains it (e.g., 1 with 5; 6 with 9) are part–whole correlations and are shown for completeness only.

Governance-regime profiles (RQ1)

The three sampled universities, each representing a different governance regime, differed significantly on every variable (Table 3). Regime A (public-like) scored lowest on all four ODNA blocks; its ODNA total (M = 61.03) was about one standard deviation below Regimes B (M = 73.08; d = 1.03) and C (M = 75.28; d = 1.20), which did not differ from each other. The regimes showed distinct strengths: Regime B (private-like) scored highest on Motivators and Employability Sustainability, whereas Regime C (national-like) scored highest on Structure (d = 1.07 vs. B; d = 1.55 vs. A), Institutional Resilience and Knowledge Continuity. Regime differences were large for the ODNA blocks and Employability Sustainability (ω^2 = .09–.25) and smaller for Institutional Resilience (ω^2 = .06) and Knowledge Continuity (ω^2 = .03).

Table 3. *ODNA and Academic Sustainability by governance-regime profile: means (SD), Welch ANOVA and Games–Howell contrasts*

	Regime A	Regime B	Regime C	Welch ANOVA				
Variable	(n = 298)	(n = 154)	(n = 80)	F	df_2	p	ω^2	Contrasts
Decision Rights	15.52 (3.78)	17.79 (3.55)	18.20 (4.16)	26.65	199.0	< .001	.09	A≠B, A≠C
Information Flow	15.23 (3.72)	18.60 (3.74)	18.02 (3.67)	48.23	204.6	< .001	.15	A≠B, A≠C
Motivators	15.38 (3.84)	19.71 (3.48)	18.36 (3.98)	76.82	202.8	< .001	.21	A≠B, A≠C, B≠C
Structure	14.91 (3.88)	16.97 (3.64)	20.69 (3.15)	95.97	220.2	< .001	.23	A≠B, A≠C, B≠C
ODNA total	61.03 (11.88)	73.08 (11.36)	75.28 (12.05)	78.22	203.5	< .001	.23	A≠B, A≠C
Institutional Resilience	18.00 (3.57)	17.88 (3.76)	20.46 (3.08)	21.13	213.9	< .001	.06	A≠C, B≠C

Knowledge Continuity	16.37 (3.94)	17.03 (4.02)	18.40 (3.90)	8.63	204.2	< .001	.03	A≠C, B≠C
Employability Sustainability	15.51 (3.76)	20.06 (3.55)	18.99 (3.57)	88.49	207.9	< .001	.25	A≠B, A≠C
Academic Sustainability total	49.89 (9.15)	54.97 (9.13)	57.85 (9.10)	31.49	204.1	< .001	.10	A≠B, A≠C

Note. Regime A = public-like profile; Regime B = private-like profile; Regime C = national-like profile. Contrasts list the pairs that differ at $p < .05$ (Games–Howell). Composites use the purified item sets. Profiles are anonymized governance-pattern contrasts, not institutional rankings.

Multivariate group effects (RQ1, RQ3; H3)

In the main-effects MANOVA on the seven dimensions (Table 4), governance-regime profile had a large multivariate effect (Wilks' $\Lambda = .468$, $F(14, 1036) = 34.17$, $p < .001$, partial $\eta^2 = .316$). Faculty type ($\Lambda = .987$, $F(7, 518) = 0.97$, $p = .456$), academic rank ($p = .729$) and administrative position ($p = .948$) had no significant effects. Univariate follow-ups (Appendix D, Table D1) confirmed regime effects on all seven dimensions and no faculty-type effect on any, either adjusted or unadjusted (all $p \geq .14$). H3 was therefore not supported.

Table 4. *Main-effects MANOVA on the seven dimension composites*

Effect	Wilks' Λ	*F*	df_1	df_2	*p*	Partial η^2	Pillai's *V*
Governance-regime profile	.468	34.17	14	1036	< .001	.316	.617
Faculty type (STEM vs Hum./Soc. Sci.)	.987	0.96	7	518	.456	.013	.013
Academic rank	.980	0.75	14	1036	.729	.010	.020
Administrative position	.987	0.47	14	1036	.948	.006	.013

Note. Dependent variables: Decision Rights, Information Flow, Motivators, Structure, Institutional Resilience, Knowledge Continuity and Employability Sustainability. All four factors were entered simultaneously (main effects only; no interaction terms, because several higher-order cells contained fewer than five cases). Partial $\eta^2 = 1-\Lambda^{1/s}$. Pillai's trace led to identical conclusions. Levene's tests across regimes were non-significant for all seven dimensions ($p \geq .166$).

Predicting Academic Sustainability from ODNA (RQ2; H1, H2a–d)

Controls alone explained 10.8% of the variance in Academic Sustainability (Table 5). Adding the four ODNA blocks raised R^2 to .657, $\Delta R^2 = .550$, $F_{change}(4, 520) = 208.48$, $p < .001$, supporting H1. In the final model (Table 6) every block made a unique positive contribution: Information Flow ($\beta = .30$), Motivators ($\beta = .27$), Decision Rights ($\beta = .25$) and Structure ($\beta = .22$), all $p < .001$, supporting H2a–d. Multicollinearity was acceptable (VIF ≤ 2.07). General dominance weights (Table D2) ranked Information Flow first (28.8% of the ODNA increment), followed by Decision Rights, Motivators and Structure; the differences between blocks were modest, so the ranking should not be over-interpreted.

Among the controls, only Regime B was significant: at equal ODNA levels, respondents in the private-like profile reported lower Academic Sustainability than those in Regime A ($B = -2.41$, p

< .001). The coefficients of the four blocks were similar when the controls were omitted (R^2 = .646; β = .25, .28, .23 and .24).

Table 5. *Hierarchical regression: variance explained by the ODNA blocks over and above the control variables*

	Step 1: Controls		Step 2: + ODNA		Change		
Outcome	R^2	Adj. R^2	R^2	Adj. R^2	Δ R^2	$F_{change}(4, 520)$	p
Academic Sustainability (total)	.108	.096	.657	.650	.550	208.48	< .001
Institutional Resilience	.065	.053	.450	.439	.385	90.99	< .001
Knowledge Continuity	.035	.022	.434	.422	.399	91.60	< .001
Employability Sustainability	.253	.243	.563	.554	.310	92.25	< .001

Note. Step 1 entered governance-regime profile (two dummies; reference = Regime A), faculty type (STEM = 1), academic rank (two dummies; reference = lecturer/assistant professor) and administrative position (two dummies; reference = none), *df* = 7, 524. Step 2 added Decision Rights, Information Flow, Motivators and Structure simultaneously. No stepwise selection was used.

Table 6. *Final regression model predicting Academic Sustainability (total) from ODNA, adjusting for controls*

Predictor	B	SE_{HC3}	β	t	p	95% CI for B	VIF
Constant	12.78	1.34	—	9.56	< .001	[10.16, 15.41]	—
Controls							
Regime B (private-like)	−2.41	0.64	−.11	−3.76	< .001	[−3.66, −1.15]	1.40
Regime C (national-like)	−0.39	0.81	−.01	−0.48	.631	[−1.98, 1.20]	1.39
STEM faculty	−0.02	0.51	−.00	−0.04	.971	[−1.01, 0.98]	1.02
Associate professor	−0.57	0.58	−.03	−0.99	.325	[−1.72, 0.57]	1.12
Professor	0.08	0.71	.00	0.11	.913	[−1.32, 1.47]	1.11
Head of department	0.37	0.63	.01	0.58	.560	[−0.88, 1.62]	1.04
Vice dean / dean	−0.41	0.96	−.01	−0.43	.671	[−2.30, 1.48]	1.05
ODNA blocks							
Decision Rights	0.60	0.08	.25	7.18	< .001	[0.44, 0.76]	1.77
Information Flow	0.72	0.09	.30	7.88	< .001	[0.54, 0.90]	1.96
Motivators	0.62	0.08	.27	7.37	< .001	[0.45, 0.79]	1.91
Structure	0.50	0.09	.22	5.43	< .001	[0.32, 0.68]	2.07

Note. R^2 = .657, adjusted R^2 = .650, $F(11, 520)$ = 99.00 (HC3-robust Wald), p < .001. Standard errors and confidence intervals are heteroscedasticity-consistent (HC3). β = standardized coefficient (for dummy variables, β is scaled by the dummy's SD and is reported for reference only).

At the dimension level (Table 7), ODNA added 38–40% of explained variance for Institutional Resilience and Knowledge Continuity and 31% for Employability Sustainability, and all four blocks were significant in each model. Information Flow and Motivators were the strongest predictors of Institutional Resilience (β = .26 each) and Information Flow of Knowledge Continuity (β = .26), whereas Decision Rights and Information Flow led for Employability Sustainability (β = .22). The regime controls diverged by dimension: compared with Regime A at the same ODNA level, Regime B reported lower Institutional Resilience (β = −.32) and Knowledge Continuity (β = −.22) but higher Employability Sustainability (β = .23).

Table 7. *Standardized coefficients of the ODNA blocks for each Academic Sustainability dimension (RQ2)*

Predictor	Institutional Resilience	Knowledge Continuity	Employability Sustainability	Academic Sustainability (total)
Decision Rights	.18***	.19***	.22***	.25***
Information Flow	.26***	.26***	.22***	.30***
Motivators	.26***	.23***	.18***	.27***
Structure	.17***	.21***	.15**	.22***
Regime B (private-like)	−.32***	−.22***	.23***	−.11***
Regime C (national-like)	−.02	−.09*	.06	−.01
STEM faculty	.04	−.00	−.04	−.00
R^2 (full model)	.450	.434	.563	.657
Δ R^2 for ODNA	.385	.399	.310	.550

Note. Each column is a separate model containing all four ODNA blocks and all seven control variables (rank and administrative-position coefficients are omitted from the table; none reached $p < .05$ except Associate professor for Knowledge Continuity, β = −.08, $p = .025$). HC3 robust tests. $^{*}p<.05$; $^{**}p<.01$; $^{***}p<.001$.

Measurement model

The seven-factor CFA (M1) fitted the data closely (Table 8): $\chi^2(539) = 505.20$, $p = .849$, CFI = 1.000, RMSEA = .000 [.000, .009], SRMR = .019. Because a non-significant χ^2 and $\chi^2/df < 1$ are unusual for a 35-indicator model, we rely on SRMR and on model comparisons and treat the fit as evidence of adequacy rather than of superiority. Standardized loadings ranged from .831 to .896 (Table 9; Appendix B); CR ranged from .921 to .946 and AVE from .700 to .777. Every √AVE exceeded the construct's largest latent correlation (maximum φ = .652, Information Flow–Employability Sustainability), and every HTMT was below .85 (maximum .651), supporting discriminant validity.

Table 8. *Fit of the measurement and structural models*

Model	χ^2	*df*	*p*	χ^2/df	CFI	TLI	RMSEA [90% CI]	SRMR
M1. Seven correlated factors (CFA)	505.20	539	.849	0.94	1.000	1.002	.000 [.000, .009]	.019
M2. Single common factor	8233.68	560	< .001	14.70	.562	.534	.161 [.158, .164]	.108
M3. M1 + unmeasured method factor	500.06	538	.878	0.93	1.000	1.002	.000 [.000, .008]	.022
M4. Higher-order structural model	537.34	547	.608	0.98	1.000	1.001	.000 [.000, .013]	.028
M5. M4 + seven control variables	883.23	757	< .001	1.17	.993	.992	.018 [.012, .023]	.036

Note. Maximum-likelihood estimation; $N = 532$; 35 indicators (M5 additionally includes seven observed dummy-coded controls). TLI values above 1.00 indicate $\chi^2 < df$. M4 vs M1: $\Delta\chi^2(8) = 32.14$, $p < .001$. M3 constrains the method-factor loadings to equality.

Table 9. *Reliability, convergent validity and discriminant validity (model M1)*

Construct	Items	λ range	α	CR	AVE	√AVE	Max. φ (with)	Max. HTMT
Decision Rights	5	.856–.877	.938	.938	.753	.868	.617 (ES)	.617
Information Flow	5	.860–.887	.941	.941	.762	.873	.652 (ES)	.651
Motivators	5	.869–.882	.943	.943	.769	.877	.639 (ES)	.638
Structure	5	.867–.896	.945	.946	.777	.881	.596 (IF)	.595
Institutional Resilience	5	.831–.846	.921	.921	.700	.837	.572 (KC)	.573
Knowledge Continuity	5	.857–.886	.939	.940	.757	.870	.572 (IR)	.573
Employability Sustainability	5	.872–.886	.945	.945	.776	.881	.652 (IF)	.651

Note. λ = standardized loading; CR = composite reliability; AVE = average variance extracted; φ = latent correlation; HTMT = heterotrait–monotrait ratio. DR = Decision Rights; IF = Information Flow; MO = Motivators; ST = Structure; IR = Institutional Resilience; KC = Knowledge Continuity; ES = Employability Sustainability. Fornell–Larcker criterion (√AVE > max. φ) and HTMT < .85 were met for every construct. Item-level loadings are in Appendix B.

Common-method variance.

A single-factor model (M2) fitted very poorly ($\chi^2(560) = 8233.68$, CFI = .562, RMSEA = .161), and the first unrotated factor accounted for 48.0% of the item variance. However, adding an unmeasured method factor (M3) indicated that, on average, 28.9% of item variance was shared across all constructs. Partialling this factor attenuated the latent correlations between ODNA blocks and Academic Sustainability dimensions from .49–.65 to .15–.46 (Table 10). The equal-loading method factor also absorbs genuine shared trait variance, so these adjusted values are a conservative bound; nevertheless they show that a substantial part of the observed association reflects common-source perceptions, which we take into account in interpreting effect magnitudes.

Table 10. *Latent correlations from the CFA (below diagonal) and after partialling an unmeasured method factor (above diagonal, italics)*

	DR	IF	MO	ST	IR	KC	ES
DR	—	*.36*	*.30*	*.29*	*.17*	*.24*	*.39*
IF	.61	—	*.37*	*.36*	*.21*	*.30*	*.46*
MO	.57	.60	—	*.30*	*.15*	*.22*	*.45*
ST	.56	.60	.55	—	*.24*	*.28*	*.34*
IR	.53	.54	.49	.54	—	*.27*	*.12*
KC	.54	.56	.50	.54	.57	—	*.26*
ES	.62	.65	.64	.57	.47	.52	—

Note. Below diagonal: model M1. Above diagonal: model M3, in which every indicator also loads (with an equality constraint) on an orthogonal method factor that accounts for 28.9% of item variance on average. Because an equal-loading method factor also absorbs genuine shared trait variance, the values above the diagonal are best read as a conservative lower bound.

Structural model

The higher-order model without controls (M4) fitted well in absolute terms ($\chi^2(547) = 537.34$, p = .608, CFI = 1.000, RMSEA = .000, SRMR = .028), although it fitted significantly worse than

the correlated-factor CFA ($\Delta\chi^2(8) = 32.14$, $p < .001$), indicating that the second-order factor does not reproduce all associations among the three dimensions. The model with controls (M5) also fitted well: $\chi^2(757) = 883.23$, $p = .001$, $\chi^2/df = 1.17$, CFI = .993, TLI = .992, RMSEA = .018 [.012, .023], SRMR = .036.

In M5 (Table 11, Figure 2), all four ODNA blocks had significant positive paths to Academic Sustainability: Information Flow (β = .355), Motivators (β = .320), Decision Rights (β = .284) and Structure (β = .243), all $p < .001$. Regime B again had a negative net path (β = −.127, p = .004); no other control was significant. Academic Sustainability loaded on Employability Sustainability (.748), Knowledge Continuity (.707) and Institutional Resilience (.697). The model-based R^2 for the second-order factor was .915, but this value refers to the variance shared by the three dimensions, is computed from same-source perceptions, and should not be read as the proportion of observed sustainability explained; the observed-score R^2 (.657) is the more conservative estimate.

Table 11. *Structural estimates of the higher-order model without (M4) and with (M5) control variables*

	M4: No controls				M5: With controls			
Path	*B*	*SE*	β	*p*	*B*	*SE*	β	*p*
Decision Rights → AS	0.179	0.029	.288	< .001	0.183	0.030	.284	< .001
Information Flow → AS	0.190	0.028	.330	< .001	0.212	0.031	.355	< .001
Motivators → AS	0.157	0.026	.274	< .001	0.190	0.030	.320	< .001
Structure → AS	0.155	0.027	.257	< .001	0.152	0.031	.243	< .001
AS → Institutional Resilience	1.000	—	.672	—	1.000	—	.697	—
AS → Knowledge Continuity	1.123	0.092	.691	< .001	1.109	0.087	.707	< .001
AS → Employability Sustainability	1.320	0.101	.776	< .001	1.227	0.099	.748	< .001
Regime B (private-like) → AS		—			−0.137	0.048	−.127	.004
Regime C (national-like) → AS		—			−0.028	0.049	−.021	.564
STEM faculty → AS		—			−0.005	0.029	−.005	.877
Associate professor → AS		—			−0.032	0.034	−.030	.348
Professor → AS		—			0.008	0.040	.006	.850
Head of department → AS		—			0.024	0.038	.019	.527
Vice dean / dean → AS		—			−0.023	0.049	−.014	.639
R^2: Academic Sustainability		.908				.915		
R^2: Institutional Resilience		.452				.486		
R^2: Knowledge Continuity		.477				.500		
R^2: Employability Sustainability		.602				.559		

Note. AS = Academic Sustainability (second-order factor). The AS → Institutional Resilience loading was fixed to 1 for identification. Standard errors from the observed information matrix. In M5 the controls were allowed to covary freely with the four ODNA factors. R^2 for Academic Sustainability is model-based (proportion of second-order factor variance explained) and is inflated by shared method variance (see Table 10).

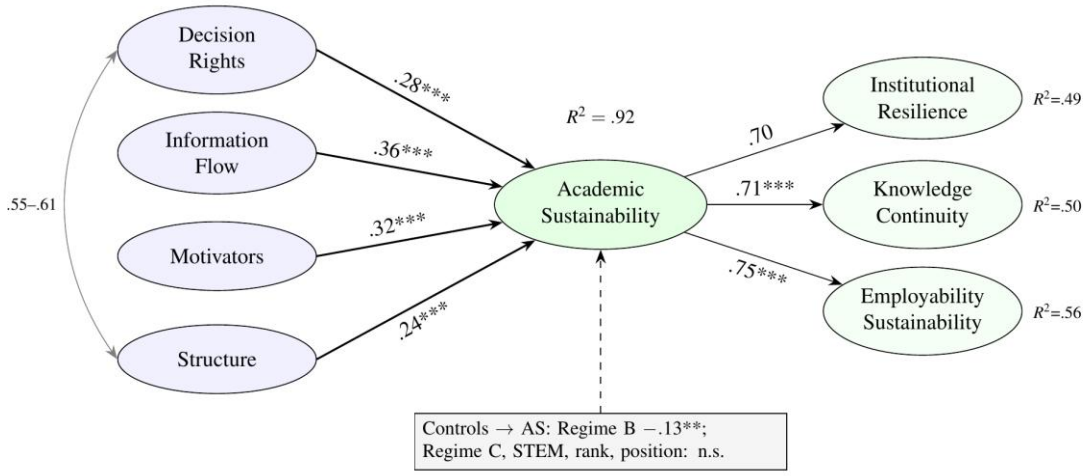


Figure 2. *Standardized estimates of the higher-order structural model with controls (M5). Measurement part (35 indicators) omitted for clarity; the curved arrow summarizes the six latent correlations among the ODNA blocks (.55–.61). ** p < .01; *** p < .001; the loading on Institutional Resilience was fixed for identification.*

Summary of quantitative results

Across observed-score regressions and latent models, with and without controls, the same pattern held: all four ODNA blocks were uniquely and positively associated with perceived Academic Sustainability and with each of its dimensions, Information Flow carried the largest weight, governance-regime profile was the dominant contextual factor, and faculty type, rank and administrative position were not associated with the outcomes. Effect magnitudes should be read in light of the common-method sensitivity analysis.

Qualitative Findings

Leadership orientations

Leaders' accounts revealed five recurring interpretive orientations toward governance constraints: reformist (emphasizing agility, delegation, global standards, and industry coupling), pragmatist (focusing on crisis management and operational resilience), traditionalist (prioritizing stability, institutional identity, and protective compliance), strategist (centering on systems thinking, data governance, and future-oriented structures), and innovator (advocating boundary-crossing, practice-based learning, and the disruption of inherited norms). These orientations represent a qualitative spectrum of administrative philosophies rather than mutually exclusive participant categories; a leader could express more than one orientation in different contexts. The orientations did not map onto specific academic disciplines. Accordingly, no mutually exclusive orientation counts are presented.

Cross-cutting governance tensions

Four tension axes recurred across interviews: (1) centralization vs. delegation—who can act, how fast and with what discretion; (2) seniority vs. competence—how leaders are selected and

authority justified; (3) routine vs. strategy—how attention is captured by operational "fires"; and (4) window dressing vs. transparency—how the truth of reports is verified. Table 12 summarizes the themes, illustrative quotations and their salience.

Academic Sustainability as a lived capability

Leaders described the three dimensions as practically separable but interdependent. Institutional Resilience was associated with crisis learning, frontline readiness and digital infrastructure; Knowledge Continuity with mentoring, leadership pipelines, research institutionalization and protection against brain drain; and Employability Sustainability with durable skills (problem-solving, ethics, emotional intelligence), portfolios, advisory boards and real-world engagement. Skill longevity was linked less to static content than to abstraction, ethics and practice-based learning.

Deep-seated barriers

Asked which single established norm they would remove, leaders most often named bureaucracy (paperwork, procurement delays, compliance load), seniority-based governance (rank–power coupling, waiting for one's turn) and a theory-over-practice bias (lecture-centric teaching and rote examination). In ODNA terms, these norms constrain decision rights, distort motivators and degrade the credibility of information.

Table 12. *Themes from the leadership interviews (N = 25)*

Theme	Core codes (examples)	Illustrative quotation	*n* (%)	ODNA link
Centralization blocks execution speed	delegation of hiring, budgets and curriculum; approval bottlenecks; "tied hands"	"Let us change 30% of our content every semester without a 2-year approval cycle."	14 (56)	Decision Rights: slows adaptation and curriculum updating
Bureaucracy and procurement friction	paperwork; bidding rules; centralized purchasing; meeting overload	"Buying seeds shouldn't take 6 months of bidding."	9 (36)	Structure: raises transaction costs; delays units and renewal
Routine "firefighting" crowds out strategy	maintenance; student disputes; crisis workload	"I spend 90% of my time on 'fires'."	6 (24)	Structure/Decision Rights: leaders as operational managers
Transparency workarounds vs. window dressing	random walk-ins; dashboards; peer monitoring; audits	"The 'window dressing' in reports is a huge issue; I do 'random walk-ins'."	5 (20)	Information Flow: trust deficit in reporting; need for verification
Seniority vs. competence	"waiting one's turn"; rank–power coupling	"Snipping the 'seniority-based leadership' norm."	4 (16)	Decision Rights/Motivators: misallocated authority
Incentives beyond pay	consultancy prestige; legacy; protégés; intrinsic discovery	"Drivers … are 'consultancy prestige' and 'legacy'."	4 (16)	Motivators: status, impact and mentorship
Skill longevity through abstraction and ethics	logic over tools; lifelong learning; adaptability	"We don't teach software; we teach logic. Logic doesn't expire."	6 (24)	Employability Sustainability as durable capability
Practice-based learning vs. lecture/exam tradition	project-based; portfolio assessment; anti-rote	"Change the 'lecture-hall only' norm. Law is practiced, not just read."	5 (20)	Structure/Decision Rights → employability
Second-tier leadership capacity	"digital natives" waiting; financial literacy gaps; brain drain	"They are waiting for their 'turn' in the hierarchy."	4 (16)	Knowledge Continuity: leadership pipeline
Digitalization as resilience infrastructure	digital labs and library; hybrid learning	"Resilience means digital labs."	5 (20)	Institutional Resilience via Information Flow and Structure

Note. n = interviews in which the theme was explicitly present at least once; salience in this sample, not a population estimate. Quotations are anonymized English translations checked for semantic equivalence; identifying institutional or disciplinary details have been generalized.

Integration of Findings

Table 13 aligns the principal quantitative results with the qualitative mechanisms. Three findings were confirmed or elaborated, two were expanded (one tentatively), and one showed partial divergence.

Table 13. *Joint display of quantitative and qualitative findings*

Quantitative finding	Qualitative mechanism	Fit	Meta-inference
Information Flow had the largest unique weight (β = .30; SEM β = .36; 28.8% of ODNA Δ R^2)	Window dressing, distrust of reports, verification workarounds (walk-ins, dashboards)	Confirmation and elaboration	What matters is the *credibility* of information, not its volume; verification capacity is a lever.
Decision Rights uniquely predicted all dimensions (β = .18–.25), most strongly Employability Sustainability	Centralized approval of curricula, hiring and budgets (56% of interviews)	Confirmation	Bounded delegation is a precondition for timely curriculum renewal.
Regime A lowest on every ODNA block; Structure showed the largest regime contrast (ω^2 = .23), highest in Regime C	Procurement and committee friction; digital infrastructure as resilience	Expansion	Structure differentiates institutional contexts more than individuals; infrastructure investment and procedural simplification go together.
Motivators contributed uniquely (β = .27) and were highest in Regime B	Drivers beyond pay: prestige, legacy, mentorship, impact	Elaboration	Recognition systems need to reward mentoring and continuity, not only outputs.
Regime B: higher Employability Sustainability but lower Resilience and Knowledge Continuity at equal ODNA	Leadership pipelines, brain drain and seniority norms constrain continuity	Tentative expansion	Labour-market orientation may not by itself secure continuity; interpretation is tentative because interviewees' regimes are not linked to quotes.
No faculty-type differences (Wilks' Λ = .987, p = .456)	Leaders described discipline-specific incentives and practice norms	Partial divergence	Disciplines differ in *what* they renew, but faculty perceive the governance conditions that enable renewal similarly across disciplines.

Discussion

This study tested a governance-execution model linking the four ODNA blocks to a perceived Academic Sustainability capability in Egyptian higher education. With a consistent, purified item set and controls for institutional context and respondent characteristics, all four blocks were uniquely and positively associated with Academic Sustainability and with each of its dimensions, and leaders' accounts identified the mechanisms through which these associations plausibly operate.

Interpretation

First, ODNA was strongly associated with perceived Academic Sustainability: the four blocks explained 55% of the variance beyond controls. This supports the proposition that a university's capacity to protect learning, renew knowledge and maintain graduate relevance depends in part on its internal design, not only on resources or strategy documents (Neilson et al., 2008; Luo et al., 2024). Because a substantial share of the association reflects common-source perceptions, the magnitude is likely overstated; the direction and the consistency across models are the more robust findings.

Second, Information Flow carried the largest or joint-largest weight in the total-score regression, in the models for Institutional Resilience and Knowledge Continuity, and in both latent models (Decision Rights was marginally stronger for Employability Sustainability). Interviews indicate why: leaders distrust performative reporting and build workarounds to verify what is happening. Institutions that cannot see themselves accurately cannot adapt, which aligns with the emphasis on reflexivity and information infrastructures in sustainability governance (Glass & Newig, 2019; Leal Filho et al., 2023). The differences among the four blocks were nonetheless modest, and the results are better read as support for the systemic view of ODNA—the blocks matter jointly—than as a strict ranking.

Third, the governance-regime profile was the dominant contextual factor. The public-like profile scored lowest on every ODNA block, and the national-like profile scored highest on Structure, Resilience and Knowledge Continuity, consistent with its newer infrastructure. The private-like profile showed a distinctive pattern: high Motivators and Employability Sustainability, but lower Resilience and Knowledge Continuity than its ODNA level would predict. One interpretation is that market-oriented governance strengthens graduate relevance faster than it builds research continuity and institutional memory; this interpretation is tentative and requires institution-level data.

Fourth, faculty type was unrelated to ODNA and Academic Sustainability. Leaders described discipline-specific incentives and practices, but faculty members across disciplines perceived their governance conditions similarly. Governance design therefore appears to operate at the institutional rather than the disciplinary level, which is consistent with the large regime effect.

Fifth, the higher-order representation of Academic Sustainability was supported in absolute terms but fitted less well than a model with three correlated dimensions, and the dimensions related differently to context (e.g., Regime B). Future work should consider analysing the dimensions separately as well as jointly.

Theoretical contributions

The study (a) extends ODNA from strategy execution into higher education governance and shows that its four blocks can be measured reliably and discriminantly among faculty; (b) reframes Academic Sustainability as a governance-execution capability rather than a purely symbolic, environmental or resource-based construct; (c) shows, through integration, that the credibility of information and the allocation of authority are the mechanisms most directly linked to this capability in the studied context; and (d) connects internal university governance to the

institutional dimension of the SDGs, offering ODNA as a lens for analysing the organizational conditions under which universities contribute to SDG 4, SDG 8 and SDG 16.

Practical implications

Universities seeking to sustain academic renewal should (1) build *truthful visibility*: treat dashboards, quality-assurance data, research tracking and graduate outcomes as learning infrastructure with verification, rather than as compliance artefacts; (2) move from permission-based to responsibility-based *bounded delegation*, especially for curriculum updating, partnerships and crisis response; (3) redesign *motivators* so that mentoring, teaching innovation, continuity and external engagement are recognized alongside publications; and (4) reduce *procedural friction*—duplicated committees, multi-layer approvals and procurement delays. Because regime differences were large, reform priorities should be tailored: centralized profiles may benefit most from delegation and information credibility, and market-oriented profiles from investments in continuity and institutional memory.

Implications for the Sustainable Development Goals

The findings carry three implications for the role of universities in sustainable development. First, they suggest that progress on SDG 4 and SDG 8 in higher education is constrained less by stated commitment than by execution capacity: faculty who reported stronger decision rights, more credible information and better-aligned incentives also reported a greater institutional capacity to keep education continuous, knowledge renewing and graduates employable, which are the institutional conditions underlying Targets 4.3, 4.4 and 8.6. Second, the prominence of Information Flow speaks directly to SDG 16. Transparent and verifiable reporting is both a governance outcome in its own right (Target 16.6) and a precondition for SDG monitoring in universities, because sustainability reporting that is performative cannot guide adaptation (Leal Filho et al., 2023). Investing in credible institutional data—quality-assurance evidence, research tracking and graduate-outcome systems—therefore serves academic renewal and SDG accountability at the same time.

Third, the bounded delegation and participation that leaders called for correspond to the responsive and participatory decision-making envisaged in Target 16.7, and the regime contrasts indicate that SDG-oriented reform should be differentiated: centralized profiles may advance sustainability goals most through delegation and information credibility, whereas market-oriented profiles may need to protect knowledge continuity so that short-term employability gains do not come at the expense of long-term research capacity. For policymakers in Egypt and comparable systems, the results imply that national SDG and Egypt Vision 2030 targets for higher education are more likely to be met when they are accompanied by internal governance reform rather than by additional strategy documents alone (Ministry of Planning, Monitoring and Administrative Reform, 2016). These implications are offered cautiously, because the outcomes are perceived institutional capabilities rather than measured SDG indicators.

Limitations and future research

Several limitations qualify these conclusions. (1) The data are cross-sectional and self-reported from a single source; associations are not causal, and the method-factor analysis indicates that common-source variance inflates their magnitude. Multi-source designs (e.g., leaders' ratings,

administrative indicators of curriculum updating, retention and graduate outcomes) and longitudinal data are needed. (2) The four negatively worded ODNA items could not be used, so each ODNA block rests on five positively worded items, which leaves acquiescence and wording effects untested; future versions should include balanced, validated reversed items. (3) The instrument was developed for this study and requires replication, including measurement invariance across institutional types. (4) Each governance regime is represented by one institution; differences cannot be separated from institution-specific characteristics, and nesting of faculty within institutions could not be modelled with so few clusters. (5) The CFA fit was unusually close for a model of this size; independent replication is required. (6) The qualitative phase captured senior leaders only and did not link interviewees to regime profiles; faculty, student, employer and policy perspectives should be added. (7) Academic Sustainability as measured here concerns organizational capacity to sustain academic work; it does not capture environmental sustainability, sustainability curricula or student learning outcomes. Future research should link ODNA to direct SDG indicators, such as institutional SDG reporting, graduate employment outcomes and SDG-aligned research output.

Conclusion

Organizational DNA is closely associated with how faculty perceive their institution's capacity to remain resilient, to renew knowledge and to keep graduates relevant. All four building blocks contributed uniquely, credible information flow mattered most consistently, and institutional governance context mattered far more than discipline, rank or administrative role. Leaders' accounts showed how centralization, performative reporting, incentive design, procedural friction and seniority norms translate governance design into everyday constraints. Strengthening Academic Sustainability may therefore depend less on new strategies than on redesigning the internal architecture through which universities decide, see, reward and coordinate. Because effective, transparent and participatory institutions are themselves a Sustainable Development Goal, such redesign is not only an internal management concern but also a practical route through which universities can sustain their contribution to quality education, decent work and the wider 2030 Agenda.

Declarations

Ethics approval.

Approved by Research Ethics Committee of the Faculty of Education, Beni-Suef University, Ref. BSU-EDU/REI-2025-0812; conducted in accordance with the Declaration of Helsinki and applicable institutional regulations. The study was classified as minimal risk.

Consent to participate.

Written informed consent was obtained from all participants.

Clinical trial number: not applicable.

Consent to Publish declaration: not applicable

Competing interests.

The authors declare no competing interests.

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Author contributions.

Withheld in the blinded version; provided in the submission system.

Data and code availability.

De-identified survey data, the codebook and the analysis code that produces every table are available from the corresponding author on reasonable request, subject to ethics restrictions. Interview transcripts are not shared because of the risk of deductive identification of senior leaders; coded extracts may be made available on reasonable request.

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Instruments as administered

A.1 Demographic items

1. University type: Public / Private / National (*Ahliyya*) — reported as Regimes A, B and C.

2. Faculty type — analysed as Humanities & Social Sciences vs. STEM. The administered response choices were 1 = Humanities and Social Sciences and 2 = STEM.

3. Academic rank: Lecturer (Assistant Professor) / Associate Professor / Professor. Original response codes were 1 = Lecturer (Assistant Professor), 2 = Associate Professor, 3 = Full Professor and 4 = Assistant Lecturer / Demonstrator. Codes 1 and 4 were pooled for the reported three-category rank variable. As code 4 may represent pre-faculty appointments, the combined category should not be interpreted as consisting entirely of faculty with independent voting rights.

4. Administrative position: None / Head of Department / Vice Dean or Dean.

A.2 Survey items

Response scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. Items marked † are negatively worded; they were reverse-scored and then excluded from all analyses (see Section 4.5 and Appendix C). Codes in brackets are those used in Appendix B.

Q	Item	Code
Organizational DNA — Decision Rights		
1	I have sufficient authority to develop the scientific content of my courses flexibly.	DR1
2	Department council decisions are approved by faculty leadership without hindering modifications.	DR2
3	I clearly know the limits of my responsibilities and the decisions I can make independently.	DR3
4	Decisions pile up in the Dean's or Vice-Dean's office (high centralization).†	excl.
5	I actively participate in making strategic decisions for the faculty.	DR4
6	Procedures for forming viva and examination committees are fast and flexible.	DR5
Organizational DNA — Information Flow		
7	I receive information and new university regulations clearly and on time.	IF1
8	Information is transparently transmitted from senior management to scientific departments.	IF2
9	Effective channels exist to share research ideas and expertise across departments.	IF3
10	I rely on "rumors" to know what is happening due to the absence of official channels.†	excl.
11	The faculty provides an accessible database regarding research opportunities and grants.	IF4
12	There is a clear mechanism for faculty members to submit complaints and get feedback.	IF5
Organizational DNA — Motivators		
13	The rewards and promotion system is truly linked to performance and research quality.	MO1
14	Individual initiatives and extra efforts are fairly recognized (materially and morally).	MO2
15	Nepotism/favoritism affects appointments and committees more than competence.†	excl.
16	The current work climate motivates me to exert effort beyond the basic job description.	MO3
17	Research achievements (e.g., international publishing) receive more recognition than routine work.	MO4
18	I am satisfied with the fairness of teaching and supervision load distribution.	MO5
Organizational DNA — Structure		
19	The organizational structure allows for forming cross-disciplinary research teams easily.	ST1
20	Committees and councils consume significant time without producing effective decisions.†	excl.
21	The hierarchy facilitates workflow and does not constitute a bureaucratic obstacle (red tape).	ST2
22	Coordination between departments (Graduate Studies, Student Affairs, etc.) is seamless.	ST3
23	The administrative structure responds quickly to changes (e.g., quality assurance, digitalization).	ST4
24	Flexible boundaries between departments encourage interdisciplinary research.	ST5
Academic Sustainability — Institutional Resilience		
25	The faculty effectively maintained educational quality during emergencies and crises.	IR1
26	The faculty has ready-made contingency plans for sudden changes (resource shortages, etc.).	IR2
27	Faculty management responds quickly to resolve emerging student or faculty problems.	IR3
28	The infrastructure is capable of accommodating modern shifts in teaching methods.	IR4
29	Institutional errors are treated as learning opportunities, not just for punishment.	IR5

Q	Item	Code
Academic Sustainability — Knowledge Continuity		
30	A second and third generation of researchers is being prepared efficiently for the future.	KC1
31	The faculty provides an attractive environment that prevents "brain drain" to other entities.	KC2
32	Effective mentoring mechanisms exist to transfer expertise from senior to junior faculty.	KC3
33	Research work is institutional and continuous; it does not collapse if specific individuals leave.	KC4
34	The faculty invests in continuous professional development programs for its members.	KC5
Academic Sustainability — Employability Sustainability		
35	Regulations and curricula are updated regularly to keep pace with global labor market shifts.	ES1
36	Our graduates enjoy a competitive reputation and high demand in the labor market.	ES2
37	There are real and effective partnerships between the faculty and labor market institutions.	ES3
38	Academic programs focus on future skills (critical thinking, digitalization) rather than rote learning.	ES4
39	The faculty has a system to track alumni and measure employer satisfaction.	ES5

A.3 Interview guide (senior academic leaders)

1. **Opening.** What distinctive "trait" makes your faculty unique compared with its peers? If you had to describe the spirit of the faculty in one word (formal, family-like, competitive), what would it be, and why?

2. **Decision rights.** Which decisions do you wish were fully delegated to departments? Do current regulations "tie your hands" regarding innovation?

3. **Routine vs. strategy.** Do you spend more time "extinguishing daily fires" than on strategic planning?

4. **Information credibility.** How do you ensure that reports submitted to you reflect reality without "window dressing"?

5. **Motivators.** Beyond financial incentives, what drives a professor to keep excelling after reaching full professorship?

6. **Resilience.** What is the most important lesson your institution learned from COVID-19 or economic crises?

7. **Knowledge continuity.** Are you confident that a "second tier" of leaders exists to carry the torch?

8. **Employability.** How do you ensure that graduates' skills will not expire within five years?

9. **Transformation question.** If you had a "genetic scissor" to change one established norm in the organizational culture of Egyptian universities, what would it be and why?

Item-level statistics and loadings

Table B1. *Item-level statistics and CFA loadings (model M1; N = 532)*

Item	Q no.	*M*	*SD*	Skew	Kurt.	CITC	λ_{std}	λ (*SE*)
DR1	Q1	3.35	0.88	−0.07	−0.33	.83	.856	0.756 (0.031)
DR2	Q2	3.30	0.87	−0.08	−0.18	.83	.865	0.753 (0.030)
DR3	Q3	3.29	0.89	−0.08	−0.25	.84	.875	0.778 (0.031)
DR4	Q5	3.29	0.86	−0.02	−0.35	.83	.867	0.749 (0.030)
DR5	Q6	3.35	0.91	−0.05	−0.46	.84	.877	0.799 (0.032)
IF1	Q7	3.32	0.93	−0.13	−0.44	.85	.886	0.819 (0.032)
IF2	Q8	3.31	0.89	−0.12	−0.23	.83	.862	0.764 (0.031)
IF3	Q9	3.32	0.92	−0.05	−0.28	.84	.870	0.799 (0.032)
IF4	Q11	3.34	0.87	−0.09	−0.45	.83	.860	0.749 (0.030)
IF5	Q12	3.34	0.89	−0.12	−0.25	.85	.887	0.787 (0.030)
MO1	Q13	3.40	0.93	−0.09	−0.47	.85	.880	0.822 (0.032)
MO2	Q14	3.40	0.92	−0.10	−0.30	.85	.882	0.816 (0.032)
MO3	Q16	3.44	0.94	−0.12	−0.40	.84	.869	0.815 (0.033)
MO4	Q17	3.42	0.95	−0.10	−0.47	.85	.875	0.829 (0.033)
MO5	Q18	3.43	0.95	−0.14	−0.47	.85	.880	0.835 (0.033)
ST1	Q19	3.29	0.90	−0.09	−0.41	.84	.867	0.783 (0.031)
ST2	Q21	3.26	0.90	−0.07	−0.24	.86	.891	0.804 (0.031)
ST3	Q22	3.26	0.95	−0.14	−0.42	.84	.867	0.820 (0.033)
ST4	Q23	3.27	0.95	−0.18	−0.31	.86	.896	0.855 (0.032)
ST5	Q24	3.30	0.95	−0.07	−0.48	.85	.885	0.845 (0.033)
IR1	Q25	3.63	0.84	−0.22	−0.06	.79	.832	0.700 (0.030)
IR2	Q26	3.69	0.86	−0.33	−0.10	.80	.842	0.728 (0.031)
IR3	Q27	3.65	0.84	−0.21	−0.32	.79	.831	0.695 (0.030)
IR4	Q28	3.68	0.83	−0.16	−0.43	.81	.846	0.702 (0.030)
IR5	Q29	3.68	0.83	−0.25	−0.25	.79	.833	0.689 (0.030)
KC1	Q30	3.39	0.88	−0.12	−0.51	.84	.869	0.766 (0.031)
KC2	Q31	3.36	0.88	−0.09	−0.28	.83	.860	0.753 (0.031)
KC3	Q32	3.37	0.87	−0.15	−0.13	.82	.857	0.747 (0.031)
KC4	Q33	3.37	0.91	−0.16	−0.44	.84	.877	0.802 (0.032)
KC5	Q34	3.38	0.93	−0.02	−0.43	.85	.886	0.822 (0.032)
ES1	Q35	3.49	0.91	−0.12	−0.48	.85	.880	0.802 (0.031)
ES2	Q36	3.46	0.94	−0.21	−0.27	.85	.886	0.830 (0.032)
ES3	Q37	3.47	0.94	−0.24	−0.21	.85	.885	0.829 (0.032)
ES4	Q38	3.47	0.96	−0.26	−0.17	.85	.883	0.845 (0.033)
ES5	Q39	3.46	0.92	−0.16	−0.23	.85	.872	0.803 (0.032)

Note. Q no. = position in the administered questionnaire (Appendix A). CITC = corrected item–total correlation within the item's own five-item scale. All loadings $p < .001$.

Diagnostics for the excluded negatively worded items

Table C1. *Diagnostics for the four negatively worded ODNA items (after reverse-scoring)*

Item	Intended scale	*M*	*SD*	*r* with own scale (pooled)	Mean within-regime *r* with own scale	η² (regime)	α with item	α without item
Q4	Decision Rights	2.80	1.18	−0.02	−0.42	.58	.823	.938
Q10	Information Flow	2.77	1.17	0.02	−0.46	.58	.838	.941
Q15	Motivators	2.78	1.18	0.08	−0.46	.57	.854	.943
Q20	Structure	2.79	1.19	−0.03	−0.49	.56	.835	.945

Note. "Own scale" = sum of the five positively worded items of the intended dimension. η² = proportion of item variance associated with governance-regime profile (cf. .06–.20 for positively worded ODNA items). Mean inter-correlation among the four items = .86.

Supplementary analyses

Table D1. *Faculty-type comparison (unadjusted) and univariate follow-ups to the MANOVA*

	Hum./Soc. Sci.	STEM	Welch *t*		Regime (adj.)		STEM (adj.)	
Variable	(*n*=255)	(*n*=277)	*t*	*p*	*F*(2, 524)	Partial η²	*F*(1, 524)	*p*
Decision Rights	16.35 (3.89)	16.79 (4.02)	1.30	.195	26.44	.092	1.15	.285
Information Flow	16.41 (3.92)	16.83 (4.14)	1.20	.231	47.56	.154	0.86	.354
Motivators	16.96 (4.23)	17.19 (4.25)	0.64	.525	71.69	.215	0.10	.751
Structure	16.40 (4.17)	16.35 (4.27)	−0.12	.908	77.96	.229	0.15	.700
ODNA total	66.11 (13.14)	67.17 (13.58)	0.91	.362		—		
Institutional Resilience	18.11 (3.64)	18.55 (3.67)	1.41	.160	16.38	.059	2.16	.142
Knowledge Continuity	16.78 (4.07)	16.95 (3.96)	0.50	.620	8.48	.031	0.10	.751
Employability Sustainability	17.36 (4.26)	17.35 (4.20)	−0.02	.985	86.49	.248	0.23	.632
Academic Sustainability total	52.24 (9.81)	52.85 (9.50)	0.73	.465		—		

Note. Adjusted tests are Type II univariate ANOVAs including regime, faculty type, rank and administrative position. With a Bonferroni-corrected α = .05/7 = .007, regime effects were significant for all seven dimensions ($p < .001$) and faculty-type effects for none.

Table D2. *General dominance weights of the ODNA blocks (Academic Sustainability total; controls held constant)*

ODNA block	General dominance weight	Share of ODNA Δ R^2
Information Flow	.158	28.8%
Decision Rights	.138	25.1%
Motivators	.134	24.3%
Structure	.120	21.8%
Total	.550	100%

Note. Weights are each block's average increment in R^2 across all subset models of the other ODNA blocks, with the seven controls always included; they sum to the ODNA Δ R^2 in Table 5.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

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