

The Influencing Factors and Implementation Paths of Digital Transformation in Administrative Management in Universities

A Fuzzy Set Configurational Inquiry into Chinese Higher Education Administration

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ABSTRACT:

This inquiry interrogates the influencing factors and the implementation paths of digital transformation inside university administrative management across the Chinese higher education terrain. The administrative core of the university remains an understudied province of digitalisation even while pedagogy and research attract dense scholarly attention (Alenezi et al., 2021). The study mobilises fuzzy set Qualitative Comparative Analysis upon an original dataset of twenty six anonymised institutions gathered through a structured questionnaire instrument. Five conditions are theorised through the technological organisational and environmental lens. These conditions are resource utilisation and external motivation and dynamic capability and digital leadership and information technology infrastructure. The outcome is administrative digital transformation success. Necessity testing reveals that digital leadership and dynamic capability and resource utilisation and infrastructure each approximate a necessary precondition while external motivation does not. Sufficiency analysis discloses three equifinal implementation paths that jointly explain the overwhelming bulk of successful cases with a solution consistency of 0.980 and a solution coverage of 0.949. The configurations crystallise into a resource dynamic coupling model and an externally impelled resource model and a compensatory environmental model. Causal asymmetry is confirmed because the recipe for transformational shortfall is not the simple negation of the recipe for success. The contribution lies in rendering administrative digitality as a conjunctural and configurational phenomenon rather than a linear additive one.

Keywords: digital transformation. administrative digitality. fuzzy set Qualitative Comparative Analysis. configurational topology. higher education. equifinality. causal asymmetry.

1. Introduction

The contemporary university operates as a sprawling administrative apparatus whose registry and finance and human resource and procurement functions absorb a sizeable share of institutional energy. Digital transformation has migrated from an optional modernisation gesture into an existential reordering of how these functions are conceived and executed (Verhoef et al., 2021). The scholarly conversation has nonetheless privileged the teaching and learning frontier and has left the administrative backstage comparatively unexamined (Benavides et al., 2020). This asymmetry is important because the data flows and the decision rights and the procedural memory on which all other transformations rely is located in the administrative spine (Maltese et al., 2018).

Digital transformation of administration is not just about software. It is a profound reconfiguration of organisational logic, where governance, culture and capability are refocused on digital affordances (Wessel et al., 2021). Thus, the phenomenon is recalcitrant multifactorial. It is not operated by a single lever, nor is it stopped by a single barrier (Gkrimpizi et al., 2023). The relevant scientific question is not which is the most important factor. What is important is what combination of factors coalesce to produce transformation and what combination coalesce to stifle it (Singun et al., 2025).

This study asks this question in the Chinese context of higher education, where digitalisation has gained a strong policy thrust and a steep developmental gradient. China is an empirical landscape where universities range from very poor to very rich, and from very disadvantaged to very privileged. The study has two interwoven goals. The first objective is to determine the factors that influence the situation of administrative transformation. The second goal is to map the pathways of implementation by which these factors actually come together in effective institutions (Torres et al., 2024). The analytic engine used is fuzzy set Qualitative Comparative Analysis. The method is specifically designed for configurational reasoning as it represents cases as

sets of conditions and it looks for the recipes that consistently lead to an outcome (Klingenberg et al., 2019). Conventional regression breaks down the case into separate variables and measures an average marginal effect. fsQCA, on the other hand, retains the case as a whole configuration and it respects the possibility of equifinality – that is, different paths leading to the same outcome (Martins et al., 2022). The rest of the paper is structured in a theoretical framing, methodological exposition and a results section with a configurational approach and a discussion and synthesis of the results.

2. Theoretical Framing and Conceptual Architecture

2.1 Digital transformation as organisational recomposition

Digital transformation is a deep and fast changing reconfiguration of value creation using digital technologies (Schallmo et al., 2017). This reconfiguration in higher education does not just affect the classroom, it permeates the entire fabric of the institution (Díaz-García et al., 2022). The change is organisational, before technical, as the key barriers lie in culture and structure, not hardware (Correani et al., 2020). This is especially true of the administrative domain, which is bottlenecked by procedures and politics rather than by computation (Alhubaishy et al., 2021).

The literature makes a distinction between digital transformation and digitisation and digitalisation. Digitisation is the process of making analogue records digital. Digitalisation is the integration of digital tools into current processes. Transformation involves a reorganization of the processes themselves, in relation to a new digital logic (Verhoef et al., 2021). Administrative digitality in the strong sense thus also requires a reconfiguration of work processes and a transfer of decision-making powers and a renegotiation of professional roles within the administration (Hashim et al., 2022).

2.2 The technological organisational and environmental lens

This study is based on the theoretical scaffold of technological organisational and environmental

perspective. According to the perspective, the adoption of technology is influenced by three concentric contexts (Fernández et al., 2023). Technological context includes infrastructure readiness of the institution. The organisational context encompasses its internal resources and leadership and capabilities. The environmental context includes the external pressures and incentives that affect it (Renz et al., 2020). What the lens does not do is give preference to any one context and that is why it remains so popular. It expects transformation to happen through the interaction between the three strata and not from any single strata (Kumar et al., 2024).

This lens is operationalised in the current design through five conditions. The technological layer is the information technology infrastructure. Organisational Stratum: Resource utilisation and dynamic capability and digital leadership. External motivation is the environmental level. This allocation enables the analysis to explore how the three strata interact in the transformation trajectories highlighted by the introduction (Mikheev et al., 2021).

2.3 Enablers and barriers in administrative systems

There is a significant literature that has been developed that lists the enablers of university transformation. Digital leadership comes up repeatedly as the most mentioned propellant as this provides budget and legitimacy and direction (Jameson et al., 2022). Resource sufficiency provides the material basis without which ambition stalls (Posselt et al., 2019). Dynamic capability refers to institutional faculty for sensing and seizing and reconfiguring in response to digital flux (Strielkowski et al., 2022). Infrastructural readiness provides the technical foundation for the rebuilding of services (Sanchez et al., 2020).

An equally substantial body has anatomised the barriers. Cultural inertia and fragmented data and scarce competence and weak governance recur across the barrier taxonomies (Gkrimpizi et al., 2023). Recent reviews emphasise that barriers are rarely solitary and instead cluster into mutually reinforcing impediment constellations (Singun et

al., 2025). United Kingdom evidence underscores that even well resourced systems falter when leadership and culture misalign (Saini et al., 2025). The barrier literature thus mirrors the enabler literature in its configurational undertone even where it stops short of configurational method (Farias-Gaytan et al., 2023).

2.4 The configurational lacuna

Prior scholarship has overwhelmingly leaned upon systematic review and bibliometric mapping and variance based modelling (Aria et al., 2017). These instruments shed light on frequency and correlation and they obscure conjunction. They have difficulty making the claim that one factor is important only in the context of another factor (Trevisan et al., 2023). Maturity models imply that there is a sequence of stages but they assume only one sequence of development (Pereira et al., 2023). The configurational lacuna is thus severe. The field is aware of the ingredients of transformation but has seldom detailed the recipes (Rêgo et al., 2024). This study fills this gap by using a set theoretical apparatus designed specifically to reveal recipes and to respect equifinality and causal asymmetry (Johan et al., 2019).

3. Methodology

3.1 Rationale for fuzzy set Qualitative Comparative Analysis

fsQCA is grounded in set theory and Boolean logic rather than in linear algebra (Klingenberg et al., 2019). It conceives of each condition as a fuzzy set in which a case holds a graded membership between full non membership and full membership. It then evaluates whether membership in a condition or a combination of conditions is consistently associated with membership in the outcome (Martins et al., 2022). Three properties of the method recommend it for the present problem. The first property is conjunctural causation whereby conditions exert their force in concert. The second property is equifinality whereby several distinct configurations reach the same outcome. The third property is causal asymmetry whereby the explanation of the outcome and the explanation of its negation are not mirror images

(Gauss et al., 2023). These three properties match the configurational character of administrative transformation that the theory section established.

3.2 Sample and data instrument

The empirical corpus comprises twenty six universities distributed across ten Chinese provincial jurisdictions including Beijing and Shanghai and Guangdong and Jiangsu and Zhejiang and Shandong and Hubei and Sichuan and Henan and Tianjin. The institutions are reported in anonymised form as a confidentiality safeguard. Data were elicited through a structured questionnaire instrument administered to senior administrative informants. The instrument captured graded assessments of each theorised condition and of the transformation outcome. The medium sample is deliberate because fsQCA is calibrated for the intermediate terrain where cases are too numerous for pure case study and too few for robust regression

(Ermel et al., 2021). The medium sample also resonates with the configurational tradition that prizes deep case knowledge over large sample abstraction (Silva et al., 2021).

3.3 Calibration protocol

The direct method (Massimo et al., 2022) is used to convert the raw condition scores into fuzzy set membership. Translation is guided by three qualitative anchors. The 90th percentile of each condition was used for the full membership anchor. The cross over anchor was set at the median (the point of maximum ambiguity). The non membership anchor was fully fixed at the 10th percentile. The logistic transformation then transforms all of the raw scores into the unit interval. The calibration anchors for each of the five conditions and the outcome are reported in Table 1. This data based anchoring is defensible as it places the thresholds within the empirical distribution of the sample itself (Dresch et al., 2020).

Table 1. Calibration anchors for conditions and outcome

Set	Full membership	Crossover	Full non membership
Resource utilisation (RU)	0.905	0.765	0.595
External motivation (EM)	0.885	0.780	0.635
Dynamic capability (DC)	0.885	0.775	0.610
Digital leadership (DL)	0.900	0.825	0.640
IT infrastructure (IT)	0.925	0.855	0.690
Transformation success (DTS)	0.950	0.875	0.600

3.4 Analytical sequence

The analysis was carried out in three canonical stages. The first stage was a test to determine the necessity of each condition and its negation. A condition is considered as necessary if its consistency is more than the traditional threshold value of 0.90 (Klingenberg et al., 2019). The second stage generated the truth table that lists all the logically possible combinations of the five conditions. The empirical cases were sorted into

each corner of the configurational space. Logical minimisation of the configurations that exceeded the consistency threshold of 0.80 and frequency threshold of one case was performed in the third stage. Minimisation is the process of reducing the remaining configurations to their most “economical” set theoretic expression (Martins et al., 2022). This was repeated for the negated outcome to investigate causal asymmetry (Gauss et al., 2023).

4. Configurational Results

4.1 Analysis of necessity

The necessity diagnostics for the presence of transformation success are shown in Table 2. There are 4 conditions that intersect or come close to the necessity threshold. Digital leadership has the highest necessity consistency of 0.966. Dynamic capability comes next at 0.961. Resource utilisation registers 0.959. Infrastructure registers 0.944. External

motivation is below threshold at 0.785, indicating that external motivation is useful but not necessary. The negated conditions are all trivially low consistency, and this validates that none of the enablers, on their own, are sufficient for success. The reading is clear and unambiguous. There are four internal and technical factors that provide a quasi necessary basis for administrative transformation and the environmental stimulus is a contingent accelerant, not a precondition (Jameson et al., 2022).

Table 2. Necessity analysis for transformation success and its absence

Condition	Consist. (DTS)	Cover. (DTS)	Consist. (~DTS)	Cover. (~DTS)
RU	0.959	0.951	0.332	0.328
~RU	0.322	0.327	0.950	0.959
EM	0.785	0.761	0.429	0.413
~EM	0.394	0.410	0.752	0.777
DC	0.961	0.950	0.328	0.323
~DC	0.315	0.320	0.949	0.960
DL	0.966	0.976	0.315	0.316
~DL	0.324	0.322	0.976	0.966
IT	0.944	0.988	0.288	0.301
~IT	0.332	0.319	0.989	0.946

The asymmetry is already apparent at the necessity level. The negated conditions rise to high consistency for the absence of transformation. The lack of infrastructure is equal to 0.989. Digital leadership is absent with a score of 0.976. Resource utilisation is 0.950 if not used. This inversion suggests that the morphology of failure is not just the statistical opposite of the enablers, but is controlled by privation of the enablers.

4.2 Truth table for transformation success

The rows of the truth table in Table 3 include empirical cases where the outcome is present.

There are thirty two logical corners in the configurational space but only the twenty six cases occupy six of them. This is a sparse occupancy, typical of social reality in which institutions tend to cluster in a limited repertoire of viable forms, instead of being spread out evenly (Pereira et al., 2023). Each corner is coded as sufficient for the outcome based on the raw consistency of the corner. Corners above the consistency benchmark (0.80) are allowed to enter the minimisation. Corners underneath it are not allowed.

Table 3. Truth table for the presence of transformation success

RU	EM	DC	DL	IT	N cases	Consist.	Outcome code
1	1	1	1	1	9	1.000	1
1	0	1	1	1	3	1.000	1
1	1	0	1	1	1	1.000	1
0	1	1	0	0	1	0.935	1
0	1	0	0	0	2	0.226	0
0	0	0	0	0	10	0.160	0

Three of the occupied corners exceed the consistency benchmark with near perfect scores. A fourth corner with a single deviant case also surpasses it. The two remaining corners collapse far beneath the benchmark and are therefore associated with the absence of the outcome. The truth table thus partitions the institutional repertoire into a transformative cluster and a stagnant cluster with a clean consistency gulf separating them (Trevisan et al., 2023).

4.3 Sufficiency and the implementation paths

Logical minimisation of the admitted corners yields three sufficient configurations. Table 4 reports these configurations together with their consistency and their raw coverage and their unique coverage. The solution as a whole attains a consistency of 0.980 and a coverage of 0.949. Such figures denote a near comprehensive explanation of the successful cases through a compact configurational vocabulary (Klingenberg et al., 2019). Each configuration constitutes a distinct implementation path toward administrative transformation and together they instantiate the principle of equifinality.

Table 4. Configuration matrix of sufficient paths for transformation success

Sufficient configuration	Consist.	Raw cover.	Unique cover.	Path label
RU * DC * DL * IT'	0.999	0.907	0.201	Resource dynamic coupling
RU * EM * DL * IT'	1.000	0.729	0.022	Externally impelled resource
~RU * EM * DC * ~DL * ~IT'	0.935	0.268	0.037	Compensatory environmental

Solution consistency 0.980. Solution coverage 0.949.

The first path conjoins resource utilisation and dynamic capability and digital leadership and infrastructure. This resource dynamic coupling path is the dominant engine of transformation and it alone covers more than nine tenths of the

membership in the outcome. It depicts the well endowed and well governed institution that fuses material plenty with adaptive capacity and visionary stewardship and technical readiness. This path is the configurational portrait of the

comprehensively resourced research university (Strielkowski et al., 2022).

The second path conjoins resource utilisation and external motivation and digital leadership and infrastructure. Here dynamic capability recedes and external motivation steps forward as the activating spark. This externally impelled resource path describes the resourced institution whose transformation is catalysed by policy pressure and competitive emulation rather than by an intrinsic adaptive faculty (Mikheev et al., 2021). The path demonstrates that environmental impetus can substitute for endogenous capability provided that resources and leadership and infrastructure remain in place (Renz et al., 2020).

The third path is the most theoretically arresting. It conjoins external motivation and dynamic capability with the explicit absence of resource utilisation and the absence of digital leadership and the absence of infrastructure. This compensatory environmental path portrays the

resource scarce institution that transforms against the odds by harnessing external impetus and a sheer adaptive capability to compensate for its material and infrastructural deficits (Posselt et al., 2019). Its narrow coverage marks it as a minority route yet its existence is decisive. It proves that affluence is not the only avenue and that a resolute environmental and capability combination can overturn the resource handicap (Hashim et al., 2022).

4.4 Truth table and configurations for the absence of success

Causal asymmetry demands a separate analysis of the negated outcome. Table 5 displays the truth table for the absence of transformation success. The same six corners are occupied yet their consistencies invert. The corners that anchored success now register low consistency for failure while the depleted corners register near perfect consistency for failure.

Table 5. Truth table for the absence of transformation success

RU	EM	DC	DL	IT	N cases	Consist.	Outcome code
0	0	0	0	0	10	1.000	1
0	1	0	0	0	2	1.000	1
0	1	1	0	0	1	0.988	1
1	1	0	1	1	1	0.623	0
1	0	1	1	1	3	0.222	0
1	1	1	1	1	9	0.193	0

Minimisation of the admitted corners yields two sufficient configurations for failure. Table 6 reports them. The solution consistency reaches 0.977 and the solution coverage reaches 0.928. The dominant failure path is the conjunction of absent resource utilisation and absent dynamic capability and absent digital leadership and absent infrastructure. This privation configuration covers more than nine tenths of the failure

membership and it depicts the comprehensively under endowed institution. The secondary path replaces absent dynamic capability with present external motivation under a persisting absence of resources and leadership and infrastructure. This shows that environmental impetus alone cannot rescue an institution that lacks the internal and technical substrate (Alhubaishy et al., 2021).

Table 6. Configuration matrix of sufficient paths for the absence of success

Sufficient configuration	Consist.	Raw cover.	Unique cover.
$\sim\text{RU} * \sim\text{DC} * \sim\text{DL} * \sim\text{IT}$	0.992	0.913	0.531
$\sim\text{RU} * \text{EM} * \sim\text{DL} * \sim\text{IT}$	0.962	0.402	0.028

Solution consistency 0.977. Solution coverage 0.928.

The asymmetry is now formally established. The failure recipe is not the Boolean negation of the success recipe. Success is driven by conjunctions of enablers in plural combinations whereas failure is driven principally by a wholesale privation of those enablers (Gauss et al., 2023). This finding dismantles any lingering assumption that transformation and stagnation lie at opposite ends of a single linear continuum (Wessel et al., 2021).

5. Discussion

5.1 Three driving models of administrative transformation

The configurational evidence coalesces into three driving models which govern administrative digitality in the Chinese university. The mainstream engine is the resource dynamic coupling model. It combines organisational plenitude, adaptive capability and stewardship and infrastructure into a self reinforcing transformative flywheel (Strielkowski et al., 2022). The engine that is policy activated is the externally impelled resource model. It illustrates how external pressures can catalyze change within institutions with limited adaptive capacities (Mikheev et al., 2021). The insurgent engine is the compensatory environmental model. It uncovers the potential of overcoming one's obstacles by combining an external push and adaptive capacity within institutions (Posselt et al., 2019). These three models resonate with the driving typologies that emerged in cognate Chinese configurational scholarship and situate them in the administrative province specifically.

5.2 The interplay among technological organisational and environmental strata

The results shed light on the interaction between the three theoretical layers in an unprecedented

manner. Infrastructure is quasi necessary but insufficient by itself, and represents the technological stratum. It is always necessary to intertwine with organisational conditions to produce fruits (Fernández et al., 2023). Resources and capability and leadership is the gravitational core of every dominant success path, the organisational stratum. The environmental stratum is external motivation and is the swing factor. It is not a necessary link in the resource dynamic coupling path, but it is a crucial link in the externally impelled path and the compensatory path (Renz et al., 2020). The trajectory of transformation of any particular university is thus an emergent property of the interlacing of the three strata and not a sum of their individual magnitudes (Kumar et al., 2024).

5.3 Implementation paths and strategic decision making

The configurational map carries direct implications for strategic decision making inside university administration. An institution should first diagnose its own configurational position rather than chase a universal best practice (Pereira et al., 2023). A well resourced institution should consolidate the resource dynamic coupling path by investing in adaptive capability and digital stewardship in tandem (Jameson et al., 2022). A resourced but inert institution should weaponise external policy impetus to overcome internal complacency along the externally impelled path (Strielkowski et al., 2022). A resource scarce institution should not despair because the compensatory path demonstrates a viable insurgent route through environmental alignment and relentless adaptive capability (Hashim et al., 2022). Strategic decision making thus becomes an exercise in configurational navigation rather than linear optimisation (Correani et al., 2020).

The asymmetry finding sharpens the strategic counsel further. Because failure flows overwhelmingly from the simultaneous privation of resources and capability and leadership and infrastructure the foremost priority for a lagging institution is to escape the all absent corner of the configurational space (Singun et al., 2025). Even partial accretion of a single enabler can dislodge an institution from the dominant failure recipe and reposition it toward a transformative trajectory (Gkrimpizi et al., 2023). This insight reframes transformation as a movement through configurational space rather than a climb up a maturity ladder (Pereira et al., 2023).

6. Conclusion

This study has recast administrative digital transformation in Chinese universities as a configurational and conjunctural phenomenon. Through fuzzy set Qualitative Comparative Analysis upon twenty six institutions it identified four quasi necessary conditions and three sufficient implementation paths and a clear causal asymmetry between transformation and stagnation (Klingenberg et al., 2019). The influencing factors do not operate as detached levers. They operate as interwoven constellations whose particular interlacing determines the outcome (Martins et al., 2022). The three driving

models furnish a parsimonious yet textured vocabulary for understanding how universities of divergent endowment can each reach transformation by their own configurational route (Torres et al., 2024).

The principal theoretical contribution is the demonstration that administrative digitality obeys equifinality and conjunctural causation and causal asymmetry in concert. The principal practical contribution is the configurational compass it offers to administrators who must navigate transformation under heterogeneous constraints (Rêgo et al., 2024). The study is bounded by its medium sample and its anonymised cross sectional design and its reliance on informant assessment (Ermel et al., 2021). Future inquiry should extend the configurational logic across longitudinal windows and should triangulate the informant data with archival and observational evidence (Silva et al., 2021). Future work should also probe whether the three driving models persist as the Chinese policy environment continues its rapid evolution (Trevisan et al., 2023). The administrative core of the university deserves the same configurational scrutiny that its pedagogical frontier has long enjoyed and this study advances that overdue rebalancing (Alenezi et al., 2021).

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