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## Building Capacity for AI Adoption through Strategic Decision-Making and Policy

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**Abstract:** The twin transition in post-Soviet innovation systems is often constrained by foundational inhibitors that dictate structural growth. This research utilises ISM and Fuzzy-MICMAC to identify leverage points within the Lithuanian ecosystem based on expert interviews. The results reveal a three-level hierarchy with Bureaucratic Friction as the foundational “gatekeeper,” but as the system stabilises, Resource and Talent Gaps become the dominant “silent driver” of long-term success, with Strategic Market Agility emerging as a symptomatic outcome dependent on resolving these underlying inhibitors. Policymakers must first “unlock the gate” of bureaucracy before addressing the resource gaps that truly sustain the ecosystem. Addressing these gaps is crucial for fostering innovation and ensuring sustainable economic development in the Lithuanian context.

**Keywords:** Twin Transition; Post-Soviet Innovation; Interpretive Structural Modelling (ISM); Fuzzy-MICMAC; Decision-Making; Leverage Points; Innovation Ecosystem; Inhibitors; Enablers; Capacity Building; EU.

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### 1 Introduction

The global race for AI adoption represents a critical component of the European Union's strategic push for a twin transition – the simultaneous digital and green transformation of the economy – requiring Regional Innovation Systems (RIS) to move beyond simple technology procurement toward comprehensive capacity building. For ecosystems navigating a post-Soviet traumatic culture, such as Lithuania, this transition is particularly complex (Fazio et al., 2024; Ozols and Avotins, 2024). While the stated goal of these transitions is to create synergies of AI and nature, the reality for developing

ecosystems like Lithuania is often characterized by a "driver-deficiency," where foundational inhibitors such as administrative friction and resource gaps set the structural ceiling for any potential growth (López-Rubio et al., 2022; Ozols and Avotins, 2024).

Current understanding of this problem is rooted in National Innovation System (NIS) theory, which defines an ecosystem through the network of institutions that initiate, modify, and diffuse new technologies, viewing AI adoption as its product (López-Rubio et al., 2022; Ozols and Avotins, 2024). Previous attempts to tackle innovation laggards have focused on mimicking Western formal institutions; however, Institutional Theory reveals that such reforms often fail when formal rules are misaligned with deeply embedded informal norms (Eesley et al., 2018). In the Baltic context, the "post-Soviet mindset" or *homo sovieticus* legacy acts as a devious "underdog" factor, fostering systemic risk aversion and a reliance on immediate asset redistribution that hampers the implementation of forward-looking policies needed for AI (Ozols and Avotins, 2024). Therefore, Lithuania's developing ecosystem is used as an exemplary case representing the broad spectrum of post-Soviet states in the EU and developing innovation systems globally that share a similar "traumatic culture", providing a clear, empirical view of how foundational inhibitors "strangle" innovation enablers during the strategic shift of the twin transition.

Previous attempts to foster AI capacity have often relied on "resource-addition" models, yet, from a dynamic capabilities perspective, a region's performance is dictated by its Absorptive Capacity (ACAP) – the ability to acquire, assimilate, and transform external knowledge into innovative outcomes (Hurtado-Palomino et al., 2022). For companies navigating the twin transition, this is particularly critical, as ICT-innovation orientation is often a necessary pre-condition for successful green transitions (Fazio et al., 2024). As innovation models have evolved from the Triple Helix toward Quadruple and Quintuple Helix architectures, there is an increasing demand to incorporate the agency of civil society and the natural environment into local productive systems (Donati et al., 2023), while building AI capacity requires high-level synergy between policy, research, and business segments. Yet, in driver-deficient systems, these potential synergies are frequently "drained" by talent shortages and intellectual barriers.

This research views the AI adoption and the whole innovation ecosystem through the lens of decision-making performance, seeking to identify what Donella Meadows defines as "Leverage Points" – specific places in a system where a small intervention can trigger a large shift in behaviour (Linnér and Wibeck, 2021). According to Meadows' theory, drivers like technological innovation and learning intervene at different places in the system hierarchy, with the mindset or paradigm of the system being the most powerful point of change (Linnér and Wibeck, 2021; Meadows, 1999).

The goal of this research is to provide a mathematically grounded structural map of these dynamics to answer the core research question: Which "silent drivers" dictate the long-term systemic influence within a post-Soviet innovation ecosystem, and how can they be prioritized to optimize decision-making for the twin transition? By employing Interpretive Structural Modelling (ISM) and Fuzzy-MICMAC, this study seeks to move the discourse from a "resource-addition" model to a "bottleneck-removal" model, providing empirical validation for the policy shifts necessary to "unlock the gate" of the ecosystem.

## 2 Methodology

The data for this study was collected through a two-stage expert engagement process conducted between December 2025 and April 2026. Initially, 24 hours of developmental interviews were conducted with 20 leaders in Lithuania, representing five key sectors: policy, successful business, research institutions, industry associations, and innovation support. Thematic analysis of these interviews presented 39 themes regarding driving powers, which were subsequently synthesised into eight critical factors (Table 1). These factors were categorised based on functional distinction (enablers vs. inhibitors), resource grounding, and causal logic requirements. In the second stage (April 2026), 15 of the original expert participants evaluated the mutual impact of these eight factors using the Godet scale (0: no impact; 1: small; 2: medium; 3: high; P: possible) (Godet, 1986). The results of these evaluations formed the basis for the subsequent structural analyses.

**Table 1.** Enabling and inhibiting factors for the innovation.

#	Factor Name	Description
<i>F1</i>	Adaptive Funding & Lifecycle Support (Enabler)	Flexible national financing that respects the natural growth stages of a company and ensures continuity from prototype to market.
<i>F2</i>	Collaborative Synergy & Reputation (Enabler)	Trust-based ecosystems where international networks, success stories, and a proven personal "track record" facilitate risk-sharing and investment.
<i>F3</i>	Strategic Market Agility & Benchmarking (Enabler)	The ability to pivot toward high-demand sectors (e.g., defense) and use quality benchmarking to achieve market dominance in niche areas.
<i>F4</i>	Regional & Infrastructure Readiness (Enabler)	Leveraging specific geographic locations, historical engineering potential, and advanced laboratory infrastructure for experimentation.
<i>F5</i>	Bureaucratic & Administrative Friction (Inhibitor)	Systemic delays caused by excessive "receipt-collecting" (biurokratija), long EU project cycles, and uncoordinated institutional fragmentation.
<i>F6</i>	Systemic Risk Aversion & Process-Focus (Inhibitor)	A culture that penalizes failure and prioritizes short-term "process" over real-world impact, leading to a fear of audits and high costs.
<i>F7</i>	Evaluative Bias & Intellectual Barriers (Inhibitor)	Obstacles created by unfair selection criteria (favouring "legacy" players), rigid academic indicators, and closed access to critical sector data/IP.
<i>F8</i>	Resource, Talent & Competitive Gaps (Inhibitor)	Barriers arising from a lack of critical mass in peripheral regions, specialized talent shortages, and the inability to compete in high-cost fundamental science.

Source: Authors' own work.

The dual-method approach was chosen to map the innovation ecosystem. The Interpretive Structural Modelling (ISM) (Sushil, 2012) is selected for its ability to organise complex factors into a clear hierarchy, identifying foundational drivers versus symptomatic

outcomes. It transforms vague mental models into a structured format by establishing the direction of influence between variables. While standard ISM uses binary logic (0 or 1), Fuzzy-MICMAC (Cross-Impact Matrix Multiplication Analysis) (Duperrin and Godet, 1973) is chosen to capture the nuance and intensity of relationships. It normalises expert scores to account for uncertainty and uses higher-order matrix multiplications (max-min composition) to reveal indirect systemic impacts and self-reinforcing feedback loops that are not visible in direct-impact assessments.

### *ISM*

To start, individual expert scores were averaged into a Consensus Matrix (Table 2). A Structural Self-Interaction Matrix (SSIM) was then developed using specific directional logic (V, A, X, O) to determine how factors interact. Later, the SSIM was converted into a Binary Reachability Matrix using a statistical threshold of 2.25 to clear the noise in data and highlight the most important relationships. A transitivity check was performed through matrix multiplication to identify "hidden" links (e.g., Factor A influencing Factor C through Factor B) and draw the final reachability matrix (

Table 3). This matrix led to level partitioning (Table 4) where factors were assigned to hierarchical levels by comparing their "Reachability Sets" (factors they influence) and "Antecedent Sets" (factors that influence them).

**Table 2.** The Consensus Matrix

	<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>	<i>F6</i>	<i>F7</i>	<i>F8</i>
<i>F1</i>	3	2,2	2,6	2,133	1,2	1,733	1,267	1,933
<i>F2</i>	2	3	2,467	2,4	1,667	1,8	1,733	2,267
<i>F3</i>	2,067	2,067	3	2,2	1,467	1,667	1,533	2,133
<i>F4</i>	1,667	2,6	2,267	3	1,133	1,533	1,4	2,4
<i>F5</i>	2,733	2,4	2,8	1,8	3	2,533	2,067	1,733
<i>F6</i>	2,067	2,2	1,867	1,533	2,133	3	1,933	1,6
<i>F7</i>	2,133	2,133	2,267	2	2,067	2,133	3	2,067
<i>F8</i>	1,867	2,533	2,733	2,667	1,667	1,933	2,067	3

Source: Authors' own work.

**Table 3.** Final Reachability Matrix (Transitivity Check), Threshold = 2,25

	<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>	<i>F6</i>	<i>F7</i>	<i>F8</i>
<i>F1</i>	1	0	1	0	0	0	0	0
<i>F2</i>	0	1	1	1	0	0	0	1
<i>F3</i>	0	0	1	0	0	0	0	0
<i>F4</i>	0	1	1	1	0	0	0	1
<i>F5</i>	1	1	1	1	1	1	0	1
<i>F6</i>	0	0	0	0	0	1	0	0
<i>F7</i>	0	0	1	0	0	0	1	0
<i>F8</i>	0	1	1	1	0	0	0	1

Source: Authors' own work.

**Table 4.** Level Partitioning, Threshold = 2,25

<i>Factor</i>	<i>Reachability (R)</i>	<i>Antecedent (A)</i>	<i>Intersection Set (R∩A)</i>	<i>Level position</i>
<i>F1</i>	F1, F3	F1, F5	F1	II
<i>F2</i>	F2, F3, F4, F8	F2, F4, F5, F8	F2, F4, F8	II
<i>F3</i>	F3	F1, F2, F3, F4, F5, F7, F8	F3	I
<i>F4</i>	F2, F3, F4, F8	F2, F4, F5, F8	F2, F4, F8	II
<i>F5</i>	F1, F2, F3, F4, F5, F6, F8	F5	F5	III
<i>F6</i>	F6	F5, F6	F6	I
<i>F7</i>	F3, F7	F7	F7	II
<i>F8</i>	F2, F3, F4, F8	F2, F4, F5, F8	F2, F4, F8	II

Source: Authors' own work.

### Fuzzy-MICMAC

The Fuzzy-MICMAC analysis began with the creation of the Fuzzy Direct Relationship Matrix (FDRM) by normalising the consensus values, achieved by dividing each score by the maximum possible value of 3 (Table 5). Higher-order systemic impacts were then calculated through successive matrix multiplications ( $M^2$  and  $M^3$ ) using the max-min composition rule. operationalised using the =MAX(MIN(...)) function in Excel. Here the "min" operator represents inhibitor logic – meaning a chain of influence is only as strong as its weakest link – and the "max" operator represents parallel path logic, selecting the strongest available route of influence between factors. Following fuzzy reflexive closure theory (Ahmad, 2024), diagonal elements were retained during multiplication to capture self-reinforcing feedback loops within the system.

**Table 5.** Fuzzy Direct Relationship Matrix (FDRM)  $M^I$ 

	<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>	<i>F6</i>	<i>F7</i>	<i>F8</i>	<i>Driving power</i>
<i>F1</i>	0,00	0,71	0,87	0,69	0,38	0,58	0,40	0,62	<b>4,24</b>
<i>F2</i>	0,62	0,00	0,80	0,80	0,53	0,60	0,53	0,73	<b>4,62</b>
<i>F3</i>	0,67	0,64	0,00	0,73	0,47	0,56	0,49	0,71	<b>4,27</b>
<i>F4</i>	0,53	0,87	0,76	0,00	0,38	0,49	0,44	0,80	<b>4,27</b>
<i>F5</i>	0,91	0,80	0,93	0,56	0,00	0,84	0,67	0,56	<b>5,27</b>
<i>F6</i>	0,67	0,71	0,58	0,51	0,69	0,00	0,58	0,51	<b>4,24</b>
<i>F7</i>	0,71	0,71	0,76	0,67	0,67	0,71	0,00	0,67	<b>4,89</b>
<i>F8</i>	0,62	0,82	0,91	0,87	0,53	0,62	0,69	0,00	<b>5,07</b>
<i>Dependence power</i>	<b>4,73</b>	<b>5,27</b>	<b>5,60</b>	<b>4,82</b>	<b>3,64</b>	<b>4,40</b>	<b>3,80</b>	<b>4,60</b>	

Source: Authors' own work.

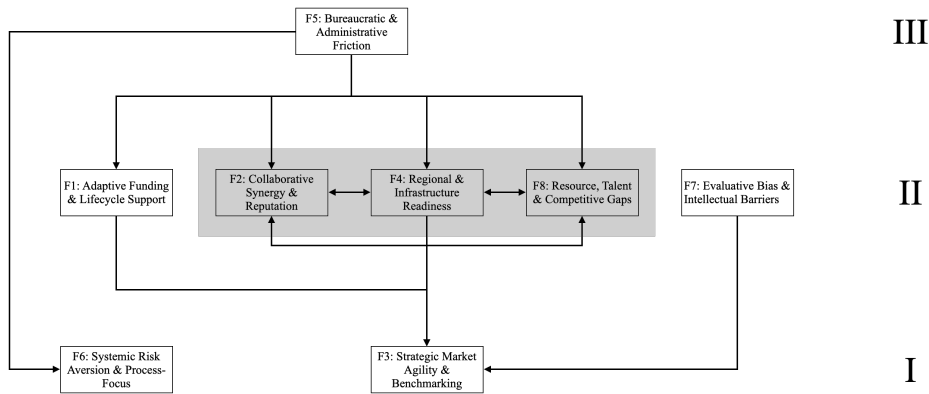
### *Robustness*

The robustness of these findings is anchored in the high level of consistency across multiple analytical frameworks and the rigorous, balanced nature of the data collection process. The balanced sampling strategy of the study gathered the data from exactly four representatives, high-ranked and valued across successful organisations of the five key segments – policy, business, research, associations, and support. This ensures the innovation ecosystem is depicted equally from every professional angle without sectoral bias. The reliability is further supported by structural validity, which is confirmed by the fact that ISM, the supplementary binary-MICMAC analysis (performed specifically to verify initial findings) and the first iteration of Fuzzy-MICMAC ( $M^2$ ) (capturing influence that travels through exactly one intermediary) all produced identical results regarding the ecosystem's core architecture. Furthermore, the Fuzzy-MICMAC outcomes demonstrated significant stability, as the classification of factors into their respective categories did not shift considerably when testing different consensus parameters ( $P=0$  and  $P=1$ ), proving the model is resilient to minor variations in expert agreement. Finally, procedural integrity was maintained by applying a consistent statistical threshold of 2.25 throughout the entire study, ensuring that the data was never manipulated and that the final results are a direct, transparent reflection of the raw expert evaluations.

### **3 Findings and discussion**

The ISM analysis establishes a three-level structural hierarchy (Figure 1) that distinguishes the foundational "root causes" of the Lithuanian innovation ecosystem from its symptomatic outcomes. At the absolute base of the system, Bureaucratic & Administrative Friction (F5) serves as the sole Level III foundational, independent driver, indicating that administrative hurdles dictate the structural limits of the entire ecosystem

while remaining largely uninfluenced by other variables. This means that enablers like Lifecycle Support (F1) and Collaborative Synergy (F2) are structurally minor to administrative hurdles. In this ecosystem, the positive forces (enablers) cannot operate effectively until the foundational negative force (inhibitor) is mitigated. The inhibitors set the "ceiling" for how much impact the enablers can have. The next, intermediate Level II, or the ecosystem's "engine room," contains a mixture of autonomous drivers like Lifecycle Support (F1) and Intellectual Barriers (F7) and linking factors Collaborative Synergy (F2), Infrastructure Readiness (F4) alongside critical inhibitor such as Resource & Talent Gaps (F8). The latter volatile elements are in feedback loop meaning they are mutually reinforcing and form a strongly connected component within the ecosystem, when any intervention in these areas will trigger rapid, potentially unstable events throughout the system. This indicates a constant struggle: the positive potential of international networks and labs is being directly drained or "neutralized" by the ongoing talent and resource shortages. The final, top-tier Level I factors, dependent Strategic Market Agility (F3) and autonomous Systemic Risk Aversion (F6), represent the system's end results. These are symptomatic indicators that cannot be improved directly but only respond when the underlying foundational layers are optimized. This suggests that "Agility" is not something that can be simply implemented. It is a symptomatic success that only occurs when the inhibitors are removed. The highest goal of the ecosystem (an enabler) is entirely at the mercy of the underlying levels of inhibitors, while the post-soviet culture depends solely on the bureaucracy. When interpreting the results through the lens of enablers (F1–F4) and bottlenecks/inhibitors (F5–F8), the data reveals a critical narrative: the inhibitors currently act as the foundational "architects" of the system, while the enablers are largely "reactive" outcomes.



**Figure 1.** ISM hierarchy graph. Source: Authors' own work.

The FDRM in fuzzy-MICMAC confirms the ISM structure for the system's two anchors – Bureaucratic Friction (F5) as the primary driver and Strategic Market Agility (F3) as the primary dependent outcome – while revealing that Intellectual Barriers (F7) and Resource & Talent Gaps (F8) carry stronger driving intensity than their mid-level ISM position suggests, and that cultural dimension of Systemic Risk Aversion (F6), though structurally downstream, operates with lower relational intensity than binary ISM implies. This pattern justifies the application of higher-order fuzzy multiplication, as  $M^3$

ultimately reconciles these tensions by stabilising the system's deep influence architecture.

The transition to Fuzzy-MICMAC (Table 6) reveals a significant "decoupling" between immediate perceptions of power and long-term systemic influence. In the FDRM (Table 5), which captures the immediate impacts experts perceive, Bureaucratic Friction (F5) is the dominant driver with a score of 5.27, suggesting that stakeholders view administrative slowness as the most visible and immediate barrier to success. However, as the system reaches a stabilized state (influence travelling through two intermediaries) through higher-order matrix multiplications ( $M^3$ ), a significant shift occurs: Resource & Talent Gaps (F8) emerges as the "silent driver" of the ecosystem. By the final iteration, F8 takes the lead as the dominant systemic force with a driving power of 6.60, while Bureaucratic Friction (F5) drops from the first to the eighth rank in systemic influence. This transformation indicates that while bureaucracy is a critical "gatekeeper" that must be addressed to start the system, it does not hold the long-term power of talent and resource availability to sustain or sink the ecosystem over time. Furthermore, Strategic Market Agility (F3) appears average as a direct driver, but through indirect paths it becomes the second most powerful force in the system. This suggests F3 acts as a major relay node – many indirect influence chains pass through it, amplifying its systemic reach beyond what direct relationships show. It is less a root cause and more a powerful transmission mechanism in the system. Finally, Intellectual Barriers (F7) are consistently important at every level of analysis, but the absolute scores change substantially (4.89 → 5.56 → 5.91), meaning its influence grows strongly in absolute terms even as its relative rank holds. This consistency across orders is itself a signal of structural robustness.

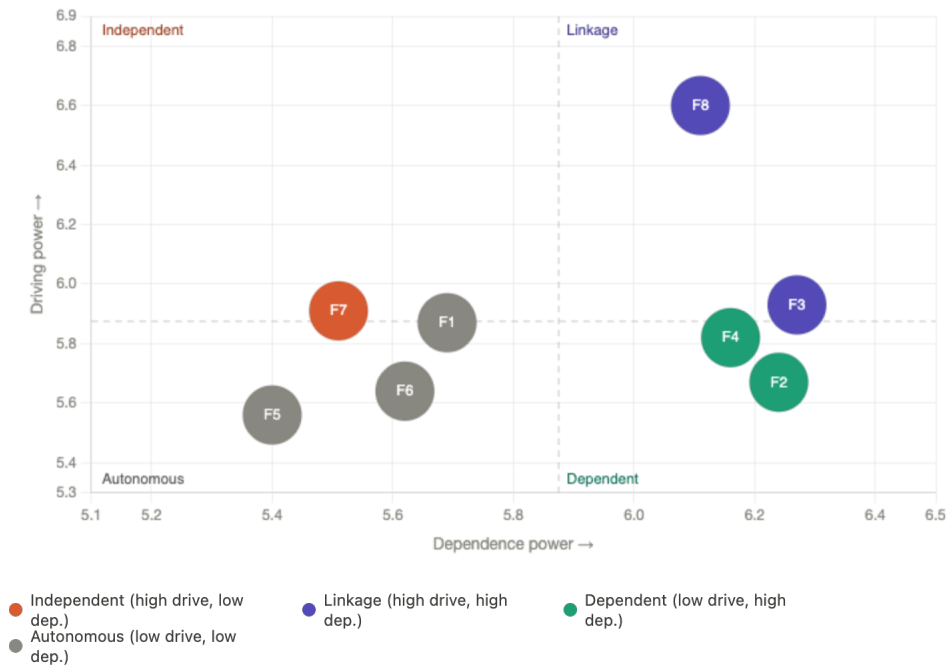
**Table 6.** Driving power ranking

<i>Factor</i>	<i>Rank FDRM (<math>M^1</math>)</i>	<i>FDRM (<math>M^1</math>)</i>	<i>Rank <math>M^2</math></i>	<i><math>M^2</math></i>	<i>Rank <math>M^3</math></i>	<i><math>M^3</math></i>
<i>F8</i>	2	5,07	1	5,89	1	6,60
<i>F3</i>	5	4,27	7	5,40	2	5,93
<i>F7</i>	3	4,89	5	5,56	3	5,91
<i>F1</i>	7	4,24	8	5,33	4	5,87
<i>F4</i>	6	4,27	4	5,64	5	5,82
<i>F2</i>	4	4,62	3	5,67	6	5,67
<i>F6</i>	8	4,24	6	5,44	7	5,64
<i>F5</i>	1	5,27	2	5,71	8	5,56

Source: Authors' own work.

The analysis of quadrant dynamics to the final stabilised state ( $M^3$ ) (Figure 2) reveals a significant evolution of power as the system moves from immediate perceptions to long-term structural reality. A primary distinction between these states is the descent of Bureaucratic Friction (F5) and the Rise of Intellectual Barriers (F7). In ISM, Bureaucratic Friction (F5) is positioned as Quadrant IV (Independent Drivers), identifying it as the primary root cause that initiates system pressure. However, by fuzzy-MICMAC, Bureaucracy drops into Quadrant I (Autonomous), revealing its role as a "gatekeeper" that is essential to address initially but lacks the long-term power to sustain ecosystem

dynamics. Conversely, Intellectual Barriers (F7) moves from the autonomous quadrant in ISM into Quadrant IV in fuzzy-MICMAC, interpreting unfair selection criteria as a more foundational, long-term driver than administrative paperwork. Further shifts occur within the volatile Quadrant III (Linkage factors) and the symptomatic Quadrant II (Dependent factors). Resource & Talent Gaps (F8) remain in the linkage quadrant across both iterations but intensifies significantly, consolidating its position as the system's dominant "silent driver". Most notably, Strategic Market Agility (F3) evolves from a purely dependent outcome in ISM (Quadrant II) into an unstable linkage factor in fuzzy-MICMAC (Quadrant III). This shift suggests that while agility is initially a "victim" of system health, it begins to generate its own momentum and influence other variables as the ecosystem matures. Meanwhile, Collaborative Synergy (F2) and Infrastructure Readiness (F4) migrate from the linkage quadrant in ISM into the dependent quadrant in fuzzy-MICMAC, officially becoming the ultimate indicators of health whose success is entirely contingent on the management of the underlying drivers.



**Figure 2.** Fuzzy-MICMAC M3 Quadrants. Source: Authors' own work.

Ultimately, these findings suggest that for companies navigating the twin transition, strategic success is dictated more by the institutional management of foundational inhibitors than by the pursuit of enablers. Decision-making must recognize Bureaucratic Friction (F5) as the essential "gatekeeper" factor that must be navigated to unlock the system, while identifying Resource & Talent Gaps (F8) as the most critical "silent driver" for long-term scalability in digital and green sectors. Because Strategic Market Agility (F3) is a symptomatic outcome of the underlying structure, firms cannot achieve rapid market pivots without first mitigating these inhibitors – including the emerging systemic influence of Intellectual Barriers (F7). Consequently, firms should prioritize building internal resource and talent resilience, as these structural lacks currently act as the primary "architects" of the ecosystem's ceiling for growth.

## 4 Contribution

This research contributes to the AI adoption and innovation management literature by offering a capacity-building perspective that explains the decoupling between visible adoption hurdles and their long-term systemic influence on strategic decision-making and policy effectiveness. Crucially, it provides empirical validation for concerns articulated by expert interviewees by translating qualitative professional assessments into a mathematically grounded structural map of AI adoption capacity. While traditional theories often prioritise enablers, this study identifies that inhibitors (F5–F8) act as foundational architects that set the growth ceiling while enablers remain largely reactive. The Fuzzy-MICMAC analysis further reveals that apparently dominant factors such as Bureaucratic Friction (F5) are systematically misunderstood, as they function primarily as strategic gatekeepers constraining decision space rather than as sustained drivers of system development. Furthermore, the work redefines Strategic Market Agility (F3) as a symptomatic outcome dependent on underlying structural health rather than a tool for implementation. These reframing shifts theoretical attention toward a capacity bottleneck logic, where the removal of foundational inhibitors is mathematically more significant for building innovation capacity than incremental enhancement of enablers. The identified Engine Room Conflict illustrates how persistent Resource and Talent Gaps (F8) neutralise the structural potential of collaboration and infrastructure, thereby limiting both organisational learning and system-level readiness for AI adoption.

The findings further contribute practical and policy-relevant insights by outlining a sequential logic through which strategic decision-makers and policymakers can build sustainable AI adoption capacity. The findings offer a sequential roadmap for leaders to optimise the innovation ecosystem, systematically confirming the structural necessity of the policy improvements requested by the experts. Policymakers must prioritise "Unlocking the Gate" by addressing Bureaucratic Friction (F5) first, as this foundational driver strangles improvements in all other areas. For strategic decision-makers engaged in the twin transition, long-term AI adoption capacity depends on "driving the engine" through sustained action to close Resource & Talent Gaps (F8), identified as the system's most powerful silent driver. Additionally, funding agencies must target Intellectual Barriers (F7), which emerges as a more significant structural barrier than traditional funding shortages over time. Industry associations gain by viewing their success in collaboration and infrastructure as indicators of systemic health entirely contingent on resolving these underlying drivers.

## Acknowledgments

Gratitude is extended to Assoc. Prof. Vytaute Dlugoborskyte, supervisors Justyna Dąbrowska (RMIT) and Prof. John Thangarajah (RMIT) for their invaluable contributions throughout this study. Furthermore, appreciation is given to the Innovation Agency of Lithuania for initiating the research and providing crucial support during data collection.

This project is Co-funded by the European Union under the Marie Skłodowska-Curie Grant Agreement No 101179842 (DREAM+PLAN). Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the Research Executive Agency; neither entity can be held responsible for them.

Throughout the development of this research, Claude, Gemini and NotebookLM served as AI assistants for ideation, editorial and visualization support. All AI-generated

suggestions were carefully reviewed and verified by the authors who remain ultimately responsible for the final published work.

## Feedback

Which areas/questions do you want feedback on at the event?

1. How should I support the clusters of the factors by literature?
2. What title would represent the research better?
3. What innovation management theories would support and emphasize my research findings?

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