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Primena poslovne arhitekture za složenost upravljanja u transnacionalnim univerzitetskim savezima

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Summary in Serbian: Izazovi u nedavno prisutnim univerzitetskim savezima koji rade na ostvarivanju evropskog stepena odnose se na dvostruku logiku: projektno zasnovan način rada vođen kratkoročnim prekretnicama i rezultatima, i ambicioznu viziju postajanja dugoročnog, misijom vođenog obrazovnog ekosistema. Ovo stvara trenje između administrativne koordinacije i strateške transformacije. Prema evaluaciji Komiteta CULT o Inicijativi evropskih univerziteta (EUI), savezi često ostaju zarobljeni u „zamci projekata“, fokusirajući se na ispunjavanje ugovornih rezultata, a ne na dizajniranje struktura upravljanja koje traju i nakon finansiranja. Da bi prevazišli ovaj kratkoročni cilj, univerzitetskim savezima su potrebni modeli upravljanja koji mogu podržati dugoročnu institucionalnu transformaciju dok upravljaju neposrednim operativnim zahtevima. Oni moraju da se kreću kroz fragmentirane pravne, administrativne i kulturne pejzaže dok teže ambicioznim ciljevima interoperabilnosti, ko-kreacije i inovacija. Da bi podržali takvu institucionalnu transformaciju, neki autori predlažu Arhitekturni okvir za sisteme visokog obrazovanja (HES) zasnovan na pogledu. Ovaj pristup prilagođava principe arhitekture preduzeća (EA) - posebno TOGAF standard - akademskim ekosistemima i nudi strukturirane smernice za usklađivanje upravljanja, strategije i komunikacije preko granica. Sistemi visokog obrazovanja funkcionišu kao složena socio-tehnička okruženja sastavljena od različitih aktera - studenata, fakulteta, administrativnog osoblja, kreatora politike - koji deluju u različitim nacionalnim kontekstima. Naše istraživanje istražuje literaturu, kao i nekoliko evropskih univerzitetskih saveza i jedan detaljno, i pokušava da argumentuje obrazloženje za poslovnu arhitekturu u visokom obrazovanju. Naš rad je usmeren ka referentnoj arhitekturi ili „meta-modelu“ koji bi mogao da vodi dizajn saveza i efikasno upravljanje širom Evrope.

Keywords : Arhitektura preduzeća, Evropski univerzitetski savezi, upravljanje, otkrivanje, interoperabilnost

Applying Enterprise Architecture for governance complexities in transnational university alliances

Abstract in English: The challenges in the lately present university alliances working towards European Degree are around the dual logic: a project-based mode driven by short-term milestones and deliverables, and an aspirational vision of becoming a long-term, mission-driven educational ecosystem. This creates friction between administrative coordination and strategic transformation. According to the CULT Committee’s evaluation of the European Universities Initiative (EUI), alliances often remain locked in a “project trap,” focusing on meeting contractual outputs rather than designing governance structures that endure beyond the funding. To move beyond this short-termism, university alliances require governance models that can support long-term institutional transformation while managing immediate operational demands. Thet must navigate fragmented legal, administrative, and cultural landscapes while pursuing ambitious goals of interoperability, co-creation, and innovation. To support such institutional transformation, some authors propose a view-based Architecture Framework for Higher Education Systems (HES). This approach adapts enterprise architecture (EA) principles - particularly the TOGAF standard - to academic ecosystems and offers structured guidance for aligning governance, strategy, and communication across borders. Higher Education Systems function as complex socio-technical environments composed of diverse actors - students, faculty, administrative staff, policymakers - operating under different national contexts. Our research explores literature, as well as several European university alliances and one in depth, and attempts to argument the rationale for Enterprise Architecture in Higher Education. Our work is towards a reference architecture or “meta-model” that could guide alliance design and effective governance across Europe.

Keywords: Enterprise Architecture, European University Alliances, governance, discovery, interoperability

1. Introduction

European university alliances, as the relatively new universe of pan-European co-creation in the higher education, operate within a dual logic: a project-based mode driven by short-term milestones and deliverables, and an aspirational vision of becoming a long-term, mission-driven educational ecosystem. This creates friction between administrative coordination and strategic transformation. According to the CULT Committee's evaluation of the European Universities Initiative (EUI), alliances often remain locked in a "project trap," focusing on meeting contractual outputs rather than designing governance structures that endure beyond the funding cycle (Craciun et al., 2023) To move beyond this short-termism, university alliances require governance models that can support long-term institutional transformation while managing immediate operational demands. One promising approach lies in the application of enterprise architecture principles tailored to the higher education context. Transnational university alliances must navigate fragmented legal, administrative, and cultural landscapes while pursuing ambitious goals of interoperability, co-creation, and innovation. To support such institutional transformation, (Rouvrais & Petersen, 2024) propose a view-based Architecture Framework for Higher Education Systems (HES). This model adapts enterprise architecture (EA) principles - particularly the TOGAF standard - to academic ecosystems and offers structured guidance for aligning governance, strategy, and communication across borders. The accelerating pace of global interdependence shaped by challenges such as climate change, technological disruption, migration, and the reconfiguration of international cooperation has fueled the rise of cross-border partnerships across sectors. These challenges increasingly transcend the capacities of individual nations, institutions, or sectors to address alone. As a result, transnational collaboration has emerged not only as a pragmatic response but as governance innovation in itself.

At the heart of these arrangements lies the concept of the ecosystem: a loosely coupled, interdependent network of actors, resources, and institutions that co-evolve around a shared value proposition. First introduced in a business context by James F. Moore, ecosystems are defined as "an economic community supported by a foundation of interacting organizations and individuals - the organisms of the business world who co-evolve their capabilities and roles and tend to align themselves with the directions set by one or more central companies" (Moore, 1993). In more recent scholarship, (Adner, 2017) reframes ecosystems as structures of interdependent actors whose alignment is necessary for the realization of value, emphasizing that it is not the actors themselves, but the interdependencies among them that define the ecosystem (Adner, 2017). This notion has since expanded beyond business into innovation systems (Jackson, 2011), environmental governance (Ostrom, 2015), and higher (Benneworth et al., 2017). Common across these domains is the shift from control to coordination, from hierarchy to co-creation, and from formal integration to adaptive alignment (Emerson et al., 2012; Nechkoska, 2019). Ecosystems emphasize distributed agency, where multiple stakeholders interact continuously in complex environments, co-producing value and collectively responding to uncertainty. One initial framework that helps unpack how ecosystems function transnationally is Collaborative Environmental Governance (CEG). As Ulibarri et al. emphasize, collaboration is particularly crucial in environmental contexts where problems are dynamic, data is uncertain, and resources are fragmented (Ulibarri et al., 2023. In such settings, transnational collaboration becomes both a necessity and an innovation, fostering ecosystems that span political, ecological, and institutional boundaries. The CEG literature offers useful insights into how such collaborations are initiated, how power and trust evolve, what governance structures support long-term functionality.

The European Universities Initiative (EUI) represents a particularly novel and ambitious application of ecosystem logic within the field of higher education. Launched in response to President Macron's Sorbonne speech in 2017 and supported through Erasmus+ and Horizon Europe funding, the EUI seeks to transform European higher education by building long-term, integrated alliances between universities across Europe. These alliances - such as EU-CONEXUS, Una Europa, and 4EU+ - are expected to function as transnational ecosystems for education, research, and innovation. Yet, as in environmental governance, establishing such ecosystems within higher education presents unique challenges: national legal frameworks differ significantly, institutional autonomy varies across systems, cultural norms, decision-making styles and languages introduce friction and coordination is often stretched across a vast web of actors with uneven power and priorities. These dynamics closely mirror what Ulibarri et al. observe in their synthesis of global collaborative governance regimes: that no universal blueprint exists for building successful transnational collaborations (Ulibarri et al., 2023). Each context requires customized practices, adaptive leadership, and tailored facilitation. "You can't apply the same methods or tools in every setting," they note, "you have to understand the local political, social, and environmental realities." For European university alliances, this means moving beyond technocratic management to cultivate co-creation, trust, and continuous sense-making among diverse stakeholders.

Our methodology deploys systematic literature review, analysis of different European university alliances on different criteria relevant for this research, and use of a case study of one European university alliance COLOURS, using Social Network Analysis, to map and model the governance contexts alliances operate in. Across the entire workflow, we used the principles of Enterprise Architecture standard – TOGAF to address the potentials of EA to transnational governance complexities in Higher Education ecosystems.

2. Literature review

This literature review builds on these insights by exploring what makes transnational ecosystems function effectively, especially when they span national, cultural, legal, and institutional boundaries. It positions European University Alliances as a compelling site of inquiry - not just as policy experiments, but as complex adaptive systems that require careful management of the human and organizational interfaces that sustain them. Specifically, it investigates how challenges related to communication infrastructure shape the collaborative capacity of these alliances.

By drawing lessons from **cross-sectoral transnational collaborations** in environmental and governance contexts, we transition to the specific characteristics of European University Alliances, before unpacking the role of communication practices and facilitation in enabling or impeding their evolution. Ultimately, the goal is to bridge abstract ecosystem theory with the practical realities of managing people, relationships, and shared meaning in one of Europe's most ambitious cross-border higher education experiments, with focus on governance complexities.

While the majority of literature on Collaborative Environmental Governance (CEG) draws from European or North American contexts, valuable insights can also be gained from large-scale, complex governance models within single political systems. The case of the Yangtze River Basin in China offers a particularly instructive example of how collaborative environmental governance functions across diverse jurisdictions, each with different levels of capacity, motivation, and autonomy. Although intra-national, the cross-provincial dynamics of the Yangtze governance system closely mirror many of the institutional and relational complexities found in transnational ecosystem collaborations. As foundational structures for collaboration Xia et al. identify a framework of internal and external factors that jointly shape the effectiveness of collaborative environmental governance (Xia et al., 2024). This framework reflects the necessity of balancing formal structures with soft relational conditions - an equilibrium similarly pursued in the design of European university alliances and cross-border environmental networks. The factors can be divided into: External (structural) factors: Legal, institutional, technical factors and internal (relational) factors: perceptual, relational, interactivity, efficacy Together, these dimensions highlight the dual importance of **hard governance architecture and soft system qualities in managing complex ecological networks.** Notably, these findings closely mirror those in EU-based ecosystems, where success is often contingent on policy frameworks and cultural/institutional alignment.

For transnational ecosystems, where legal harmonization is often slow and cultural diversity high, the insight that internal relational factors - such as trust, communication quality, mutual understanding, and belief in the efficacy of joint action - are not merely supportive of governance effectiveness but constitute its core engine, is pivotal. Governance structures must invest in trust-building, sense-making, and continuous dialogue, not just formal agreements. The internal **"infrastructure of trust"** becomes the invisible institution upon which visible structures depend. This study provides three effective collaboration models (pathways) using fuzzy-set Qualitative Comparative Analysis (fsQCA), they identified three collaborative "success pathways". These provide a nuanced view of how different configurations of factors can enable effective governance. Each model offers a transferable governance archetype relevant to transnational collaborations: Technology Empowers Relationship Driving, Institution Reinforces Interactive Driving And Internal-External Interactive Driving.

This aligns closely with Emerson and Nabatchi's (2015) view of Collaborative Governance Regimes (CGRs) as adaptive systems, shaped by changing inputs, stakeholder dynamics, and feedback over time. In their "Integrative Framework," they emphasize that no static structure is sufficient; governance must emerge through continuous alignment of shared purpose, institutional arrangements, and collaborative dynamics (Emerson & Nabatchi, 2015). Similarly, Ulibarri et al. (2023) reinforce the idea that governance must be tailored to the specific social, political, and ecological setting, supported by case-based evidence from the Collaborative Governance Case Database (CGCD) (Ulibarri et al., 2023). These insights have significant implications for the governance of transnational ecosystems where conditions differ widely across jurisdictions. Attempting to impose uniform standards or governance models can backfire if they do not match the readiness levels, incentives, and capacities of local actors. Instead, governance models must be modular, reconfigurable, and sensitive to emerging conditions - a principle

echoed in tactical management approaches like the Denica method (Petrevska Nechkoska, 2019). In practical terms, this suggests that governance design should:

- Allow for multiple entry points (e.g., legal, technical, cultural).
- Prioritize facilitative leadership that adapts strategies to shifting dynamics.
- Create mechanisms for continuous reflection and adjustment, such as feedback loops, learning cycles, and real-time dialogue.

Thus, **ecosystem governance** becomes less about enforcing uniformity and more about cultivating coherence in diversity - aligning diverse actors around shared purpose through adaptable structures and participatory processes. Effective collaboration in complex ecosystems relies not only on legal structures or formal agreements, but equally on relational factors such as trust, shared urgency, and the capacity for joint decision-making. These lessons highlight the importance of governance models that accommodate institutional diversity and functional complementarity, especially in transnational contexts like higher education. This is where the concept of hybrid governance becomes especially relevant.

Hybrid governance refers to arrangements that combine centralized policy support with decentralized execution. This model provides a flexible framework for organizing collaboration where formal authority is fragmented or limited, and where actors differ in legal status, cultural background, or strategic priorities. Rather than enforcing uniform solutions, hybrid systems rely on a blend of formal rules, informal norms, voluntary codes, partnerships, and shared platforms to guide collective action. As Gunningham (2016) notes, this shift reflects a broader transformation in governance theory - from hierarchical, top-down regulation to pluralistic, networked architectures capable of navigating complexity. Hybrid governance thus becomes a crucial enabler in contexts like transnational university alliances, where institutional misalignment, legal fragmentation, and cultural diversity render uniform governance approaches ineffective (Gunningham & Holley, 2016). Crucially, this model reconceptualizes the role of central institutions. Rather than functioning as top-down regulators, supranational bodies such as the European Commission or intergovernmental environmental regimes act as platform providers. They enable localized experimentation through funding, convening power, and legitimacy, while allowing bottom-up adaptation and co-creation. This form of facilitative centralism supports resilient and adaptive ecosystems that balance coherence with autonomy. However, the effectiveness of such systems depends on several enabling conditions:

- Trust among actors, especially in the absence of strong enforcement mechanisms
- Accountability frameworks that ensure transparency without stifling flexibility
- Intermediary organizations to bridge interests and sustain collaboration
- Shared definitions of problems and outcomes to enable alignment and learning

These findings reinforce central claims in the collaborative governance literature (Emerson & Nabatchi, 2015; Ulibarri et al., 2023) and empirical cases such as the Yangtze River Basin and EU-CONEXUS alliance. Across these contexts, the message is consistent: effective transnational ecosystems emerge not from rigid uniformity but from adaptive structures that combine centralized support with decentralized initiative, institutional scaffolding with relational trust, and hybrid mechanisms with shared purpose.

While hybrid governance provides the conceptual foundation, its effectiveness hinges on how it is operationalized through global governance mechanisms. **Global governance** refers to the collective efforts of international institutions, states, civil society actors, and other stakeholders to address cross-border issues. It encompasses processes such as agenda setting, policy implementation, and monitoring and enforcement - all of which are vital to structuring transnational collaboration. Important aspects to be incorporated to achieve hybrid governance are:

- Agenda Setting: Establishing Global Environmental and Institutional Priorities
- Policy Implementation: Coordinating Actions Across Jurisdictions
- Monitoring and Enforcement: Balancing Flexibility and Accountability

Together, the perspectives of hybrid and global governance underscore the interdependence between conceptual adaptability and operational structure. Transnational ecosystems require governance models that embrace diversity, decentralization, and experimentation, while also embedding clear mechanisms for coordination, monitoring, and accountability. Hybrid governance offers the conceptual map; global governance provides the institutional tools to navigate it. By linking the relational foundations of collaboration with structured enforcement, these combined models illuminate a path toward more resilient, inclusive, and functional transnational ecosystems.

3. Enterprise Architecture approach to transnational governance

Higher Education Systems function as complex socio-technical environments composed of diverse actors - students, faculty, administrative staff, policymakers - operating under different national contexts. (Rouvrais & Petersen, 2024) argue that a tailored Enterprise Architecture (EA) approach enables universities to manage this complexity by improving sense-making, systemic design, and collaborative alignment.

Their Architecture Development Method (ADM) outlines interconnected views for managing transformation:

A. Vision & Principles: Establishes shared strategic goals and values.
B. Business Architecture: Clarifies institutional roles, processes, and stakeholder responsibilities.
C. Information Systems Architectures: Help choose integration or new approaches or combinations
D. Technology Architecture: Extremely challenged due to the alliances' built by different universities from different regions with all different contextual factors
E. Opportunities & Solutions: Identifies shared goals and collaborative initiatives.
F. Migration Planning: Provides phased, structured implementation pathways.
G. Implementation & Governance: Establishes operational governance mechanisms and quality assurance.
H. Change Management: Supports institutional learning and adaptation.

These views are not linear steps but iterative processes - a reflection of the recursive, emergent properties common in Complex Adaptive Systems (CAS), as also described by (Petrevska Nechkoska et al., 2023). In the further discussions, we will be using these views for all the modeling discussions and choices.

4. The necessary strategic alignment in university alliances – analysis of alliances

Applying the ADM helps alliances overcome strategic challenges like governance complexity and legal disparities. For instance, EU-CONEXUS, facing national legal discrepancies complicating joint program delivery, leveraged Business Architecture (View B) by clearly defining institutional responsibilities in a cross-institutional agreement, facilitating smoother joint degree implementation. Additionally, CHARM-EU successfully implemented the Migration Planning (View F) approach, deploying a structured roadmap to incrementally integrate hybrid classrooms and align educational technology standards across its partners. This phased implementation approach improved stakeholder buy-in, resource allocation clarity, and reduced integration risks.

4.1. Towards interoperability of governance and communication

Effective governance is essential yet challenging for transnational alliances. According to the LERU report (Lievens, 2024), alliances struggle to establish stable, transparent governance. Addressing this, Implementation & Governance (View G) was utilized by Una Europa, which formalized governance structures and accountability mechanisms, improving operational transparency and strategic coherence across diverse institutional cultures. Furthermore, the Opportunities & Solutions (View E) played a pivotal role in helping CIVICA - the European University of Social Sciences - structure effective communication channels across multiple institutional levels. Recognizing the inherent complexity of transnational collaboration, CIVICA established a multi-tiered communication framework designed to bridge gaps between academic, administrative, and technical staff, ensuring that strategic objectives were translated into operational practices consistently across partners (*About CIVICA | Civica*, n.d.).

At the macro level, CIVICA instituted Alliance Coordination Committees that included representatives from each member university's leadership, policy, and governance teams. These committees were tasked with aligning strategic goals, monitoring progress on joint initiatives, and serving as a forum for resolving institutional discrepancies. Simultaneously, at the micro level, specialized working groups and task forces were formed, focusing on specific operational areas such as curriculum development, digital infrastructure, and mobility schemes. These groups maintained direct lines of communication with their counterparts across partner institutions, fostering peer-to-peer knowledge exchange and agile problem-solving. To support these interactions, CIVICA leveraged collaborative digital platforms - including shared project management tools, regular virtual meetings, and a centralized knowledge repository - ensuring that all stakeholders, regardless of institutional affiliation or role, had access to up-to-date information and decision-making processes.

This structured yet flexible communication architecture proved critical during the joint development of micro-credentials, a process that demanded both academic rigor and administrative coordination. Given the diversity of

regulatory environments, institutional cultures, and stakeholder expectations, transparent communication ensured that course design, quality assurance, and credential recognition processes were co-developed in an inclusive and coherent manner. Moreover, this approach aligns closely with the Una Europa Diversity Council's recommendations on intersectional and inclusive communication within transnational educational networks. By embedding principles of transparency, accessibility, and participatory engagement into its communication strategy, CIVICA not only enhanced operational efficiency but also fostered a sense of shared ownership among its member institutions. In essence, Opportunities & Solutions (View E) functioned as an enabling layer of governance, translating high-level strategic ambitions into coordinated, inclusive, and actionable collaboration practices - crucial for navigating the multi-institutional complexity of joint educational innovation.

4.2. Toward a Meta-Model for European Alliances

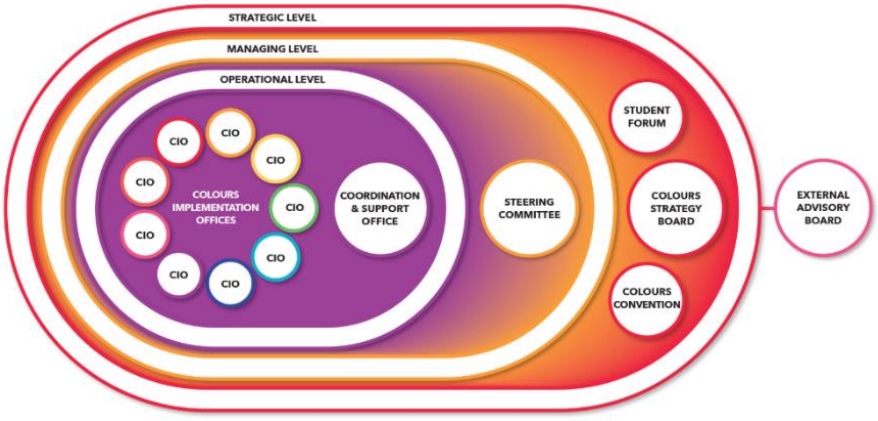
The combined views in this framework offer more than just a descriptive tool - they lay the groundwork for a reference architecture or "meta-model" that could guide alliance design across Europe. Such a model would support modular design of curricula, joint infrastructures, and strategic coordination across national boundaries. This vision is echoed in EU policy discourse: both the CULT Committee's 2023 study on the European Universities Initiative and the LERU 2024 paper call for more coherence, resilience, and legal clarity in alliance development.

By applying the Rouvrais & Petersen framework (TOGAF), alliances can identify structural bottlenecks, align their governance with institutional missions, and prototype new forms of academic cooperation. As alliances move toward long-term institutionalization, EA-based models provide the foundation for shared strategic foresight and agile transformation. While frameworks like the one proposed by Rouvrais and Petersen offer valuable tools for aligning strategy, structure, and transformation in university alliances, they cannot fully resolve the lived complexities of governance on their own. Empirical evidence from existing alliances highlights persistent tensions - between inclusivity and efficiency, standardization and autonomy, vision and viability - that architectural models alone cannot neutralize. This section complements the architectural perspective by synthesizing insights from case studies, policy evaluations, and operational experiences across European University Alliances (EUAs). It foregrounds unresolved governance challenges and offers an evidence-based overview of evolving models, practical tensions, and strategic recommendations.

4.3. Case study of a European University Alliance: COLOURS

The COLOURS European University Alliance has adopted a multi-level governance structure designed to ensure inclusivity, agility, and representativeness across all stakeholders. This architecture reflects the alliance's values of co-creation, transparency, and democratic participation, aligning closely with the principles of the European Universities Initiative. Governance is organized into three interrelated levels - Strategic, Managing/Coordination, and Operational - each with distinct roles and bodies that work in synergy to steer the alliance's development and implementation.

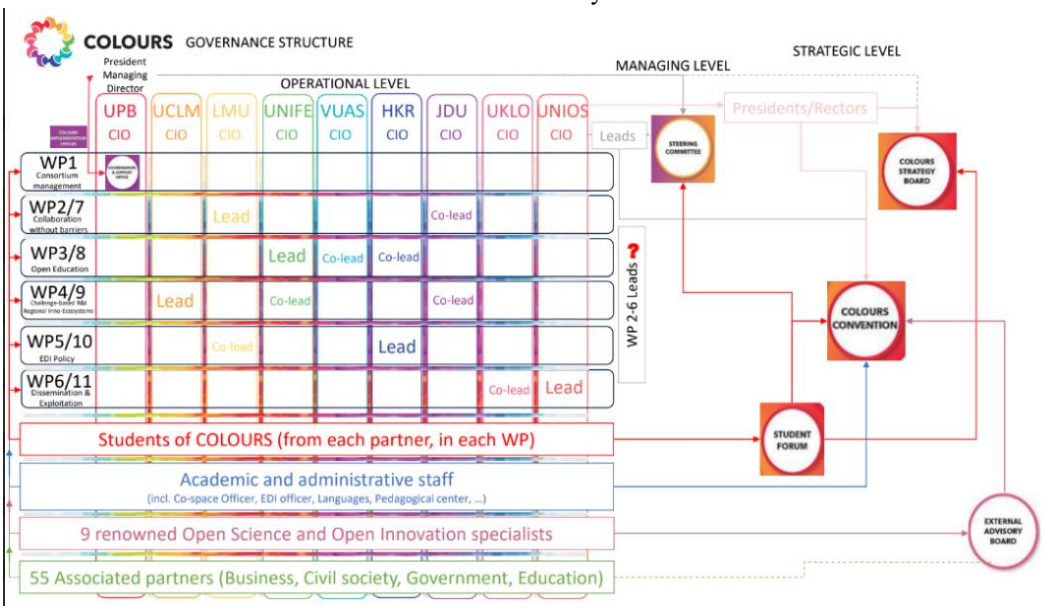
Figure 1. High level governance structure of the COLOURS European university alliance (strategic, tactical, operational and external level)



The alliance is organized into eleven major work packages (WPs), each addressing specific thematic or functional areas of collaboration: WP1: Consortium Management and Decision Making – Development, Testing,

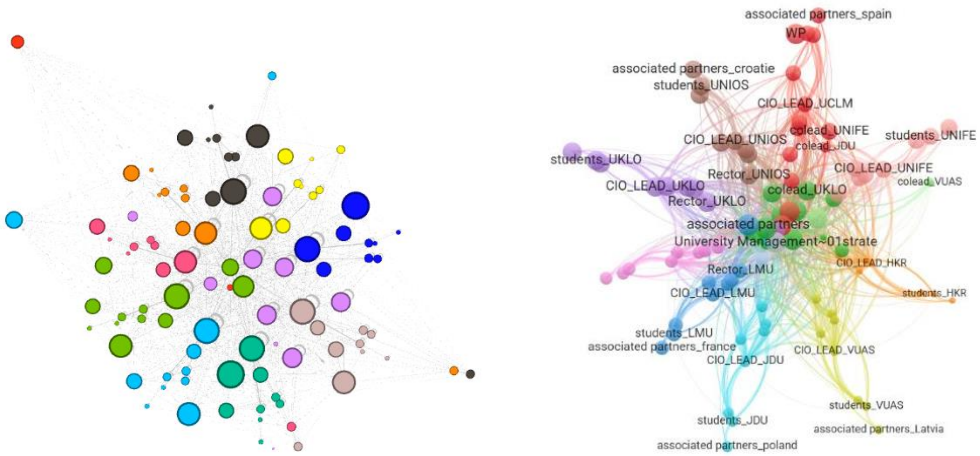
Implementation and Long-Term Sustainability, WP2/WP7: Collaboration without Barriers, WP3/WP8: Open Education (OE), WP4/WP9: Challenge-based Research & Innovation in Regional Innovation Ecosystems, WP5/WP10: Equality, Diversity, and Inclusion (EDI) Policy, WP6/WP11: Dissemination and Exploitation. Notably, each work package is led or co-led by different universities, ensuring distributed ownership and shared responsibility across the alliance. This sets the scene for multi-layered, highly complex governance ecosystem.

Figure 2. Governance structure of the COLOURS alliance across the work packages and transnational stakeholders ecosystem



The visual distinction of institutional boundaries depicted through the use of 9 different colors for each partner university within the network, providing a meaningful frame of reference for interpreting the results of cluster analysis and centrality metrics. It is particularly useful when assessing whether communication patterns are institution-bound or extend across organizational borders.

Figure 3. Governance structure of the main roles in COLOURS alliance (nodes), and their links



This visualization is particularly insightful and was generated using the Force Atlas layout in Gephi. This layout is especially suited for social network analysis, as it simulates physical forces: nodes repel each other while edges act like springs, pulling connected nodes together. The Force Atlas layout was run with inertia (0.1), repulsion strength (200), attraction strength (25), maximum displacement (10), gravity (10), speed (3.0), auto stabilization enabled with strength (80) and sensitivity (0.2), attraction distribution enabled, and without adjusting for node

size. As a result, highly connected nodes are drawn into clusters, while less connected or peripheral actors are pushed outward.

Table 3. Network metrics translated into strategic governance insights

Metric	**Value**	**Interpretation**
Average Degree	20.745	On average, each actor is connected to ~21 others. This suggests a fairly active communication network.
Avg. Weighted Degree	343.164	The average strength/intensity of connections is high. This could indicate frequent collaboration or communication. (Opsahl et al., 2010a)
Network Diameter	3	The maximum distance between any two nodes is 3. This is very low and shows a highly cohesive alliance. No one is more than 3 steps removed from anyone else. (S. Borgatti & Halgin, 2011)
Density	0.19	About 19% of all possible connections exist. This is moderate, suggesting good interconnectivity, though not saturated - still room to grow in cross-institutional links. (Provan & Kenis, 2008)

A network diameter of 3 indicates that the maximum number of steps required to connect any two nodes within the alliance is remarkably low. This suggests a high level of structural cohesion and communication efficiency across the network. In social network theory, a small diameter is associated with faster information dissemination, improved coordination, and a greater capacity for collective responsiveness (S. Borgatti & Halgin, 2011). Particularly in collaborative settings such as transnational university alliances, where cross-border complexity can hinder information flow, a compact diameter supports agile decision-making and reinforces the potential for networked governance (Provan & Kenis, 2008). From a design perspective, this reflects a well-integrated network structure, enabling actors in the alliance to access each other with minimal intermediaries - an asset for both formal coordination and informal knowledge exchange.

The network density of 0.19 indicates that approximately 19% of all possible connections within the alliance are currently active. While this reflects a baseline level of collaboration, it also reveals substantial untapped potential for strengthening interconnections, particularly between different institutions or work packages that may currently operate in relative isolation (specific nodes will be discussed). In the context of inter-organizational networks, moderate density is not inherently negative - it often signals a balance between efficiency and flexibility (Provan & Kenis, 2008). However, in alliances aiming for deep integration and joint strategic alignment, higher density can facilitate shared understanding, trust-building, and responsiveness across units. Thus, a density of 0.19 may highlight opportunities to intentionally foster cross-node collaboration, bridge communication gaps, and reinforce alliance-wide cohesion through structured interactions or co-creation initiatives.

The high average weighted degree of 343.16 suggests that, beyond simply being connected, many actors in the alliance engage in frequent or intense communication exchanges. This implies the presence of a core group of individuals or units functioning as operational hubs, characterized by strong, recurring interactions. When considered alongside the low network diameter (3) and moderate density (0.19), this pattern indicates a network in which information can circulate efficiently through a few key nodes, but where collaboration may still be concentrated rather than evenly distributed. Such concentration can be both a strength and a vulnerability. On one hand, it facilitates swift coordination through central actors; on the other, it creates a risk of communication bottlenecks or overload, particularly if those central actors are not supported by a distributed structure. These high-weight actors - especially if they also exhibit high betweenness or closeness centrality - should be flagged as potential core operators and may warrant targeted support, delegation mechanisms, or buffer roles to ensure resilience and sustainability within the alliance's communication ecosystem.

This interpretation is further supported by insights from the conducted interviews, which revealed a persistent reliance on a fragmented set of communication tools across the alliance. Platforms such as GoFAST, Google Drive, traditional email, and even informal channels like WhatsApp are concurrently in use. While each of these tools may serve distinct functional purposes - such as document collaboration, synchronous updates, or informal check-ins - the absence of a unified digital infrastructure exacerbates the risks associated with centralization. Specifically, when communication flows are already dependent on a limited set of highly active nodes, the lack of platform standardization introduces additional friction in coordination, document tracking, and institutional memory.

4.4. Interpreting Network Patterns Through Enterprise Architecture Principles

The communication dynamics within the COLOURS alliance reflect more than just informal collaboration - they reveal a latent functional architecture that maps closely onto the TOGAF inspired Architecture Development Method (ADM) (Rouvrais & Petersen, 2024). At its core, View B: Business Architecture is designed to clarify who does what in an organization, by explicitly mapping roles, interdependencies, and critical processes. In COLOURS, key actors (such as Work Package leads and CIO leads) demonstrate consistently high levels of degree, eigenvector, and betweenness centrality - indicating that they serve as operational and informational hubs within the alliance. WP leads from UCLM and UNIOS act as functional anchors around which coordination tasks and knowledge flows are organized, while CIOs from HKR, LMU, UNIFE, and others bridge institutional and thematic clusters. The Managing Director, with the highest betweenness score, functions as a cross-functional process integrator, a role precisely described in View B's logic. Meanwhile, CoSpace Officers though less central globally - are embedded within tightly knit local clusters, supporting internal cohesion and continuity. This role-based architecture is further complicated by the lack of integration of actors such as student forums and associated partners, whose peripheral positions in the network highlight an absence of formal role embedding and process alignment - gaps that Business Architecture seeks to make visible and address. One solution could be the explicit architectural recognition of these actors within the alliance's business process models - assigning them specific coordination roles, feedback loops, or inclusion in structured communication routines. However, such inclusion cannot be operationalized effectively without also addressing the underlying digital fragmentation that characterizes COLOURS' current communication ecosystem. The use of multiple, uncoordinated tools - such as GoFAST, Google Drive, WhatsApp, and various institutional platforms - creates friction, reduces transparency, and limits institutional memory. In line with View F: Migration Planning, COLOURS must adopt a phased digital integration strategy that aligns technical systems with strategic roles. This could begin with a unified communications audit and stakeholder mapping, followed by the collaborative selection of one or two core platforms to support critical workflows such as project coordination and document management. These platforms should be co-designed with end-users to ensure usability and buy-in, and managed by designated change agents - such as CIO leads or Co-Space Officers - tasked with onboarding, aligning policies, and capturing feedback throughout the transition. In this way, digital convergence and role integration become mutually reinforcing, enabling the alliance to move beyond symbolic inclusion toward operational cohesion and strategic interoperability. Finally, the tension between institutional affiliation and emergent functional clustering, as revealed in the modularity analysis, directly speaks to View G: Implementation & Governance. This view addresses how alliances translate strategic ambitions into operational structures and accountability mechanisms. The presence of high centrality among operational leads - particularly WP leads - without clear institutional integration suggests a gap between functional influence and formal governance visibility. Interestingly, such a gap appears less pronounced for CIOs, who do operate within a formal Steering Committee structure within COLOURS. This is a promising governance mechanism that aligns well with View G's emphasis on structured oversight and role clarity. However, this committee was not modelled as a single node in the network analysis, meaning its collective coordination function is not directly visible in the results. In contrast, WP leads - despite their central communicative and strategic role - currently lack a comparable governance body. This asymmetry highlights a critical opportunity for governance evolution: the establishment of a cross-institutional WP Lead Council or Coordination Forum. Such a structure would provide a formal layer of accountability, peer coordination, and strategic alignment - making explicit what is currently emergent and informal. Embedding this forum within the alliance's governance architecture and reflecting it in documentation and communication flows would strengthen implementation coherence, reduce dependence on individual initiative, and bring the COLOURS alliance closer to the architecture-aligned governance envisioned in View G. By overlaying these ADM components onto the observed network patterns, it becomes evident that COLOURS is not merely an ad hoc collaboration, but an evolving, adaptive system with the early features of architecture-informed governance. This underscores the potential of Enterprise Architecture not just as a technical schema, but as a meta-model that bridges Social Network Analysis insights with role-based coordination, phased transformation, and long-term strategic alignment across institutional and national borders.

5. Conclusion

This work explored how governance design and communication and collaboration architectures intersect within the settings, contexts and needs of European university alliances, offering an integrated analysis grounded in social network analysis (SNA), enterprise architecture, and collaborative governance theory. The findings reveal that internal communication within our case study alliance is not evenly distributed, but instead reflects a latent architecture centered on a limited number of high-performing roles (especially WP leads and CIO leads). These

individuals occupy central positions in the network, showing high degree, betweenness, and eigenvector centrality, and function as key operational and strategic nodes. However, this centralization creates systemic vulnerabilities. Actors such as student forums, associated partners, and some peripheral CIO leads are marginalized (due to the high intensity of workflows) in the alliance's structural core. Their limited connectivity, paired with high local clustering, signals functional isolation and raises concerns about inclusivity, institutional learning, and long-term resilience. These patterns can be exacerbated by a fragmented digital infrastructure, with multiple uncoordinated tools undermining transparency and institutional memory. To address these gaps, we propose a set of architectural and facilitative interventions, as well as Enterprise Architecture reasoning as foundation for the governance complexity. This will help consolidate strategic and operational roles into a unified, multi-level governance body, which appears to be needed by alliances and builds on TOGAF's View G (Implementation & Governance), operationalizing alignment across roles, institutions, and platforms. It offers a structure for data-informed decision-making, policy coordination, and cross-role learning -anchored legally through institutional statutes and Memorandums of Understanding. Complementing this structural intervention are targeted facilitation mechanisms: such as Peer Mentorship Programs and Rotating Coordination Clinics, as well as intercultural training platforms. These interventions promote adaptive governance, distributed leadership, and inclusive co-creation. In sum, this work demonstrates that Alliances must go beyond project management logic to function as resilient, collaborative ecosystems. By diagnosing communication structures, designing adaptive governance models, and embedding facilitation as a strategic resource, Alliances can evolve into more integrated and future-proof transnational entities with sustainable, beyond project effectiveness.

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