ORIGINAL ARTICLE

STAKEHOLDER AND NETWORK ANALYSIS FOR STRENGTHENING GOVERNANCE AND HEALTH POLICY IN EDUCATIONAL HOSPITALS

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ABSTRACT

This study explores how Stakeholder Analysis (SA) and Social Network Analysis (SNA) can be integrated to strengthen governance within complex health development projects. Using a mixed-method design, the research identified key stakeholders, assessed their power, interest, and commitment, and mapped both collaborative and conflictual relationships. The findings revealed that core actors such as medical institutions, project management teams, and local authorities play central roles in governance and coordination. Meanwhile, peripheral actors, including NGOs, supporting agencies, and community groups, demonstrated lower levels of engagement, highlighting potential gaps in inclusivity and sustainability. Network visualizations illustrated both strong collaborations and unresolved tensions, particularly in procurement processes and service accessibility. The study concludes that integrating SA and SNA provides a comprehensive framework for diagnosing institutional dynamics, enhancing stakeholder collaboration, and promoting sustainable, equitable governance models in health-related initiatives. These findings offer strategic insights for policy formulation and institutional planning, especially in resource-constrained and multisectoral environments.

Keywords*: *Environmental governance, stakeholder analysis, social network analysis

INTRODUCTION

Educational hospitals are multifunctional institutions that serve simultaneously as centers for healthcare services, academic training, and medical innovation. These institutions operate within a complex network of stakeholders, including universities, health authorities, medical personnel, communities, and environmental regulators, whose effective coordination is critical for institutional success. In such a multifaceted landscape, governance structures must not only ensure efficiency and service quality but also embed principles of environmental sustainability.

Hospital operations are known to exert a considerable environmental footprint, ranging from medical waste generation and energy consumption to large-scale infrastructure development. Consequently, integrating environmental governance into the planning and management of educational hospitals is increasingly essential. Effective governance in healthcare institutions requires structural mechanisms guided by policies that incorporate stakeholder interests, resource allocation, and broader social impacts. Positioning environmental concerns as a core pillar of good governance ensures that hospital development aligns with long-term sustainability goals and promotes resilience within resource-constrained environments[1,2].

In public services, especially hospitals, collaboration across stakeholder groups facilitates the exchange of diverse forms of knowledge, including scientific, experiential, and cultural, necessary for managing complex systems[3]. However, hospital environments are often marked by high urgency, which can lead to stakeholder conflicts of interests diverge or are improperly managed[4]. In educational hospitals, such conflicts may arise across strategic areas such as clinical training, healthcare policy, and infrastructure use[5]. Consequently, preemptive stakeholder mapping and alignment are essential to foster balanced collaboration and minimize potential resistance or miscommunication during project execution.

To navigate these challenges, this study employs a dual-method approach, including Stakeholder Analysis (SA) to identify, classify, and assess stakeholder influence, and Social Network Analysis (SNA) to visualize and analyze inter-stakeholder relationships. The combined use of SA and SNA offers a comprehensive perspective by evaluating both formal authority and informal influence within stakeholder

networks[6,7]. These methods have proven highly effective in environmental governance, from sustainable landscape planning in Italy[7] to water resource management in South China[8].

Incorporating SNA and SA into hospital governance research also reveals institutional power dynamics, collaboration gaps, and conflict potential, particularly key insights for planning resilient healthcare systems. For example, while SA identifies stakeholders and their priorities, SNA unveils the structure and strength of their connections[9]. Applying both tools can enhance environmental and organizational performance, enabling institutions to align stakeholder goals with sustainable governance models[10,11].

Accordingly, this study establishes four explicit objectives to guide the analysis and discussion. First, to identify and classify key stakeholders involved in the governance of educational hospitals using the power–interest matrix of Stakeholder Analysis. Second, to map the structure of collaboration and conflict relationships among stakeholders using Social Network Analysis centrality measures and network visualization. Third, to assess how stakeholder influence and network positioning may support or hinder the integration of environmental sustainability into hospital governance. Fourth, to formulate strategic recommendations for improving inclusive governance and stakeholder coordination in Indonesian educational hospitals. By addressing these objectives, this study offers a systematic foundation for strengthening governance and promoting sustainable development outcomes in educational hospital settings.

METHODS

This study will implement mixed-method research design, Quantitative, Descriptive, and Qualitative design[12]. The quantitative component consisted of stakeholder mapping and SNA using survey data to measure power, interest, and relational ties among stakeholders. The qualitative component involved semi-structured interviews with key informants to explore perceived challenges and potential solutions, which were then used to interpret and enrich the quantitative findings. Integration occurred during the interpretation phase, where network metrics were triangulated with qualitative insights to generate governance recommendations.

The study was conducted at RSPTN Unila (Unila Educational Hospital), a type-B teaching hospital affiliated with Universitas Lampung, Indonesia. The hospital is currently in its final stage of construction and has not yet commenced operations. This pre-operational status makes it an ideal case for preemptive stakeholder and network analysis, as understanding stakeholder influence, collaboration, and conflict dynamics before operations begin allows for proactive governance design and stakeholder engagement strategies. The unit of analysis was the governance stakeholder network of this planned hospital, including actors involved in strategic decision-making, policy implementation, and environmental management.

The first step is to identify the actors involved in delineating the system's boundaries, which indicates how these actors are managed. Stakeholders were identified through document analysis (hospital organizational charts, policy documents, and organigram of RSPTN Unila) and expert consultation with two senior hospital administrators. A purposive expert sampling strategy was applied to select key informants who held formal decision-making authority or were directly involved in governance processes. A total of 11 stakeholder categories were identified (see Table 1). For each category, at least one key informant who could reliably represent the category's perspective was recruited, based on the following inclusion criteria: (a) occupying a leadership or coordinating role within the stakeholder category, (b) having at least two years of experience in a relevant governance or managerial position, and (c) being directly involved in the planning, oversight, or future operation of the hospital. This approach follows established practice in healthcare SNA studies, where relational data are collected from positional representatives rather than entire populations[12].

Table 1. Categories and Identification of the Stakeholders

No.	Abbreviation	Stakeholders
1.	PD	Local Government
2.	FK	University (Faculty of Medicine)
3.	TP	Potential Medical Personnel
4.	UL	Research and Development Division
5.	PL	Patients and the Local Community
6.	TM	Hospital Project Management Team
7.	IP	Other Supporting Agencies
8.	LSM	Health NGOs
9.	MK	Medical Students
10	AU	University (Administration Party)

After identifying 10 (ten) main stakeholders (Table 1), the next step of collecting the necessary data for research was designing the survey. Data were collected between January and March 2024 using a structured questionnaire and semi-structured interview guide.

- *Questionnaire*

The instrument consisted of four sections: (1) demographics (role, tenure, education); (2) power and interest (5 items each, 5-point Likert scale); (3) institutional relationships (matrix for each stakeholder pair: 0 = no relationship, 1–5 for positive/collaborative strength; conflict relationships indicated separately with a negative sign); (4) access to information (3 items on frequency and channels of information exchange). The questionnaire was pretested with three academic experts in public health and governance, followed by a pilot test with two hospital managers not included in the final sample. Minor wording adjustments were made for clarity.

- *Interviews*

Semi-structured interviews (30–45 minutes) were conducted with all respondents from each category to explore: (a) perceived key challenges in governance and environmental sustainability, (b) mechanisms of coordination and conflict, and (c) potential solutions. Interviews were audio-recorded (with consent) and transcribed verbatim.

- *Ethical approval*

Ethical approval was obtained from the Research Ethics Committee of Universitas Lampung. Written informed consent was secured from all participants, and confidentiality was maintained by anonymizing stakeholder identities in network visualizations.

The survey consisted of two major parts, providing data for SA, and providing data for SNA.

Stakeholders Analysis (SA) Instrument

Subsequently, stakeholders' self-described roles and their levels of power and interest were used for categorization. These levels were determined by calculating the mean of stakeholders' responses using specific equations.

$$P_i = \frac{\sum_{j=1}^{N} P_{ij}}{N} \quad (1)$$

$$I_i = \frac{\sum_{j=1}^{N} I_{ij}}{N} \quad (2)$$

where,
P_i and I_i are the i^{th} stakeholder's power and interest.
P_i and I_i are power and interest amount that j^{th} stakeholder assigns to i^{th} stakeholder in their interviews.

To gauge stakeholders' information access, they rated characteristics (Table 2). The "power versus interest grid" method was used to categorize stakeholders into four quadrants including players, context setters, subjects, and observers, based on their relative positions[13].

Table 2. Characteristic and Value Scales from the Survey

Characteristic	Definition	Point Scale
Power	The capacity of stakeholders to influence in hospital governance system	1 – 5
Interest	The level of influence that hospital governance system has on interests of the stakeholders	1 – 5
Access to information	The level of difficulty or easiness to access to information on the hospital governance system	1 – 5
Institutional (formal) relationship	Identification and classification of institutional relationship between stakeholders	Magnitude: 0 – 5 Nature: 1 (conflict) +1 (collaboration)

Each stakeholder was then positioned on a power–interest grid (2×2 matrix: low/high power, low/high interest) to classify them into four categories: Key Players (high power, high interest), Keep Satisfied (high power, low interest), Keep Informed (low power, high interest), and Minimal Effort (low power, low interest).

Social Network Analysis (SNA) Instrument

All respondents in each category are identified in management institutional relationships within their organization, assessed their significance, and categorized their nature as following Table 3.

Table 3. Management Classification of Hospital Management

No.	Abbreviation	Management Class
1.	Adm-mg	Administration management
2.	Med-mg	Medicine and medical device management
3.	Pub-mg	Public service management
4.	Waste-mg	Hospital-waste management
5.	Risk-mg	Risk management

The study also considered both conflicting and collaborative inter-organizational relations. The connection strength was determined using a Likert scale[14], based on respondents' feedback. In- and out-degree centralities for each stakeholder were calculated using the following equations[15].

$$IC_j = \sum_{i=1}^{N} R_{ij} \quad (3)$$

$$OC_i = \sum_{j=1}^{N} R_{ij} \quad (4)$$

where,
IC_j and OC_i are the In- and Out-degree Centrality.

For calculating the betweenness centrality, Equation 5 is used in this study[17]. If σ_{JK} equals to the total number of geodesic paths between nodes j and k, and $\sigma_{JK}(i)$ equals to the number of these paths which pass through node i, when i, j, and k are distinct is calculated by the following equation.

$$B_i = \sum_{i \neq j \neq k} \frac{\sigma_{jk}(i)}{\sigma_{jk}} \quad (5)$$

Then, beta centrality is calculated by the following equation[16].

$$C_i = \sum_{j=1}^{N} R_{ij}(\alpha + \beta C_j) \quad (6)$$

where,
C_i and C_j are beta centralities of the i^{th} and the j^{th} nodes respectively.

In this research, the amount of this parameter is calculated as follows.

$$\beta = \frac{0.995}{MaxEigenvalue} \quad (7)$$

In Equation 7, the denominator is the maximum eigenvalue of the network's adjacency matrix. After calculating all the variables, according to the results of the interviews and adjacency matrices, social networks were drawn using NETDRAW.

RESULTS

This section presents the findings of SA and SNA applied to the development project. The analysis reveals both the distribution of power, interest, and commitment among stakeholders, as well as the quality of their relationships and coordination within the emerging governance system, particularly concerning environmental responsibility.

This study is exploratory and does not test a priori hypotheses. Accordingly, the results are presented as descriptive findings from stakeholder analysis (SA) and social network analysis (SNA), organized according to the four study objectives: (1) classification of stakeholders using power-interest scores; (2) structure of collaboration and conflict relationships; (3) positioning of stakeholders relevant to environmental sustainability; and (4) identification of descriptive patterns that may inform strategic recommendations (recommendations are reserved for the Discussion).

Stakeholder Analysis (SA) - Stakeholder Classification (Power-Interest-Commitment)

Stakeholder analysis is a critical approach for understanding the roles, interests, and influence of diverse actors involved in the development and implementation of health-related projects. Identifying key stakeholders enables more effective coordination, strategic engagement, and efficient resource allocation, all of which are essential for project success. Each stakeholder typically contributes in distinct ways, whether through policymaking, project execution, healthcare service delivery, or academic and research support.

Equally important is the assessment of stakeholders' levels of power, interest, and commitment, as these dimensions serve as key indicators for effective governance and stakeholder engagement. Power reflects the degree of influence that stakeholders hold in decision-making, interest demonstrates their investment in the project's outcomes, and commitment indicates their willingness to support implementation efforts. Table 4 summarizes the results of stakeholder interviews, presenting consolidated insights into their roles, influence, and engagement. The findings are quantified through a standardized scale, offering a structured evaluation of power, interest, and commitment indices to better understand institutional dynamics and governance challenges.

Table 4. Power, Interest, and Commitment Indices for All Stakeholders Indices

Stakeholder	Power	Interest	Commitment
PD	4.60	4.20	3.40
FK	5.00	5.00	5.00
TP	1.85	2.75	2.20
UL	2.00	3.60	2.60
PL	1.53	1.33	0.00
TM	4.20	5.00	4.80
IP	2.38	2.52	2.07
LSM	2.40	1.60	0.00
MK	3.76	3.36	4.00
AU	3.20	3.80	3.20
Mean	**3.09**	**3.32**	**2.73**

Table 4 summarized which revealed key insights about stakeholder influence, engagement levels, and collaboration potential as follows.

1) Highly Influential and Fully Committed Stakeholders

FK and TM stand out with the highest scores across all indices, reflecting their central roles in project planning, decision-making, and implementation. FK is the academic anchor of the hospital, while TM ensures operational execution.

2) Strategic Government Actor with Moderate Commitment

PD holds strong regulatory power and interest but shows moderate commitment, likely due to bureaucratic limitations and less direct involvement in operational management. Strengthening institutional collaboration and long-term funding mechanisms could enhance PD's role.

3) Moderate Influence Stakeholders with Supportive Roles

Stakeholders such as AU, UL, and MK contribute meaningfully to the hospital's governance and academic environment. While their power varies, they exhibit strong interest and/or commitment, particularly in research, education, and clinical learning.

4) Low Influence and Peripheral Stakeholders

Groups such as TP, IP, LSM, and PL remain underrepresented. These stakeholders show low scores across all dimensions, signaling a lack of integration in decision-making and hospital development. Their inclusion in engagement strategies is critical to ensuring equity, environmental responsiveness, and long-term sustainability.

Furthermore, the Power-Interest-Commitment (PIC) Grid (Figure 2) is applied to visually map stakeholders according to their level of influence (power), degree of interest, and commitment to the project. This framework facilitates the identification of stakeholders who exert the greatest impact on project outcomes and provides guidance on how they should be managed to ensure effective implementation. The grid classifies stakeholders into four categories: (1) Key Players – stakeholders with high power, high interest, and strong commitment; (2) Context Setters – those with high power but moderate levels of interest and commitment; (3) Subjects – stakeholders with moderate power, high interest, and moderate-to-high commitment; and (4) Crowds – those characterized by low power, limited interest, and low commitment.

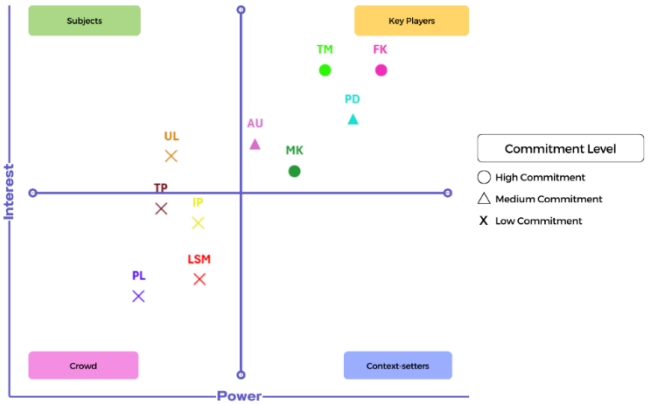

Figure 2. Power Versus Interest Grid

Figure 2 presents a visual mapping of stakeholders involved in the project based on their levels of power, interest, and commitment.

1) Key Players (High Power, High Interest, High Commitment)

This group includes FK, TM, PD, AU, and MK. These stakeholders are highly influential and deeply committed to the project. They play central roles in governance, academic planning, infrastructure development, and policy formulation. Due to their high stakes and influence, this group requires continuous engagement through strategic coordination, policy inclusion, and decision-making forums.

2) Context Setters (High Power, Moderate Interest, Moderate Commitment)

No stakeholders were identified in this quadrant, indicating that all major influential stakeholders are currently highly engaged in the project. While this reflects positively on alignment between power and engagement, it is important to monitor future actors—such as funding bodies or national agencies—that may enter this category and require targeted alignment efforts.

3) Subjects (High Interest, Moderate Power, Moderate–High Commitment)

UL occupies this quadrant. Although UL lacks high decision-making power, it is highly interested and moderately committed to the project, particularly in research and innovation. Enhanced collaboration opportunities, access to

hospital data, and integration into strategic planning could elevate UL's contribution to medical research and evidence-based governance.

4) Crowds (Low Power, Low Interest, Low Commitment)

This group includes TP, IP, PL, and LSM. These stakeholders have minimal influence or involvement in the hospital's development but are still important for long-term sustainability, community trust, and inclusiveness. Their current low engagement reflects missed opportunities, especially for patient-centered governance and public health advocacy. Future engagement strategies should aim to elevate their roles through awareness campaigns, structured dialogue, and participatory channels.

Social Network Analysis (SNA) - Collaboration and Conflict

Social Network Analysis (SNA) is a methodological approach that enables the visualization and evaluation of stakeholder relationships by examining interaction patterns, communication intensity, and strategic positioning within the network, thereby providing insights into the structure of collaboration and engagement among stakeholders in project development.

Collaborative Relationship Network Among Stakeholders

The visualization of the collaborative network in Figure 3 illustrates the interconnections among diverse stakeholders engaged in the project. The analysis highlights varying levels of interaction, coordination, and dependency across institutions, regulatory bodies, healthcare providers, and community groups. A well-functioning collaborative network is essential to ensure effective execution, sound governance, and long-term sustainability of the project.

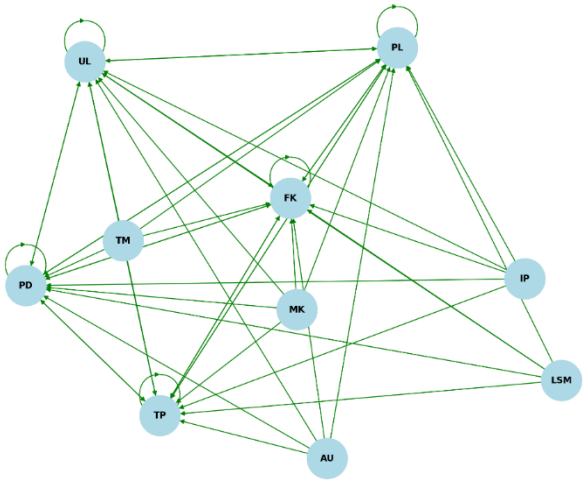

Figure 3. Social Networks of Collaborative Relationship Among Stakeholders

In addition, to provide quantitative support for the visual network (Figure 3), Table 5 reports degree centrality, betweenness centrality, and beta centrality for each stakeholder.

Table 5. SNA Centrality Scores for Each Stakeholder

Stakeholder	Degree Centrality	Betweenness Centrality	Beta Centrality
FK (Faculty of Medicine)	0.85	0.42	0.91
TM (Project Management Team)	0.78	0.38	0.87
PD (Local Government)	0.72	0.31	0.79
AU (University Administration)	0.65	0.25	0.68
MK (Medical Students)	0.58	0.19	0.55
UL (Research & Development)	0.42	0.12	0.38
IP (Supporting Agencies)	0.35	0.09	0.31
TP (Potential Medical Personnel)	0.28	0.06	0.24
LSM (Health NGOs)	0.15	0.02	0.11
PL (Patients/Local Community)	0.12	0.01	0.09

As shown in Table 5 and Figure 3, FK and TM exhibit the highest degree and betweenness centrality values, indicating the greatest number of direct collaborative ties and the most frequent positioning on shortest paths between other stakeholders. PD and AU also show relatively high centrality. In contrast, PL, LSM, TP, and IP have low degree and betweenness centrality scores, placing them at the periphery of the network.

The network visualization (Figure 3) shows direct connections between FK and PD, FK and TM, and PD and AU. IP (Supporting Agencies) are connected primarily to FK, TM, and PD. TP (Potential Medical Personnel) are connected mainly to FK and PL. PL (Patients/Local Community) show direct ties only to TP and, weakly, to PD.

Furthermore, Figure 3 illustrates the collaborative social network structure of stakeholders involved in the project. This network analysis reveals five key findings about

stakeholder connectivity, roles, and strategic partnerships as follows.

1) Regional Government (PD) and Faculty of Medicine (FK) as Coordination Centers

PD and FK emerge as the two most interconnected stakeholders, serving as the primary coordination hubs in the network. Their high connectivity with other stakeholders indicates their pivotal roles in decision-making, policy implementation, and project management.

PD plays a crucial regulatory and administrative role, ensuring that the project aligns with regional healthcare policies, funding regulations, and public health initiatives. As a government entity, PD provides licensing approvals, resource allocation, and strategic direction to integrate the hospital into the broader public healthcare system.

FK functions as the academic backbone of the project, overseeing medical education, clinical training, and research integration. FK ensures that the hospital meets teaching hospital standards, contributes to medical innovation, and supports workforce development by training future doctors and healthcare professionals.

The strong interaction between PD and FK suggests a strategic partnership where policy decisions are informed by academic expertise, and educational programs are aligned with regional healthcare needs.

2) University Administration (AU) as a Policy and Governance Supporter

AU is another highly connected stakeholder that plays a vital role in ensuring that institutional policies, governance structures, and administrative frameworks support the progress of the project. AU's involvement ensures that the hospital is financially, structurally, and academically integrated within the university ecosystem.

Its connections with FK, PD, and TM indicate its role in funding allocation, infrastructure planning, and compliance with university regulations. AU also bridges academic, financial, and operational aspects, ensuring smooth coordination between hospital management, medical faculty, and university leadership.

3) Supporting Agencies (IP) and Their Role in Project Operations

IP, including medical equipment suppliers, laboratory service providers, and pharmaceutical companies, play a crucial role in sustaining the hospital's daily operations. Their collaborative ties with multiple stakeholders (especially FK, TM, and PD) indicate their involvement in procurement, technical support, and medical supply chain management.

These agencies ensure that hospital infrastructure, medical devices, pharmaceuticals, and diagnostic services are consistently available and meet quality standards. Their engagement in the collaborative network highlights the hospital's reliance on external partnerships to maintain high-quality patient care and operational efficiency.

4) Medical Personnel (TP) and Patients/Local Community (PL) – The Direct Beneficiaries

The network visualization also emphasizes the strong relationship between TP and PL, showcasing the direct impact of the hospital project on healthcare services.

TP like doctors, nurses, and pharmacists are essential service providers within the hospital and work in direct collaboration with FK, TM, and PD. Their interactions ensure that academic training translates into real-world clinical practice. On the other hand, PL are the end beneficiaries of the project. Their engagement in the network is primarily linked to healthcare services, indicating their reliance on hospital accessibility, affordability, and medical service quality.

A strong collaboration between TP and PL ensures that patient needs are met efficiently, medical professionals receive hands-on training, and community healthcare outcomes improve.

5) Strengthening the Collaboration Mechanism

The network structure in Figure 3 reflects an already established collaboration model, but there are opportunities for improvement to enhance the effectiveness and efficiency of stakeholder interactions as follows.

- Developing a More Formalized Communication System
  - While the network shows multiple stakeholder interactions, some communication gaps may exist, particularly between regulatory bodies and community stakeholders.
  - Establishing a centralized digital platform for stakeholder coordination (e.g., an integrated hospital-university-government database) would streamline communication, document sharing, and project tracking.
- Enhancing Coordination Among Supporting Agencies (IP) and the University (AU & FK)

Strengthening contractual agreements and collaboration frameworks between the university, government, and private sector partners (e.g., medical suppliers, laboratories) would ensure sustainability in the supply of medical resources and technology.

- Expanding Community and NGO Engagement (PL & LSM)

While patients and health NGOs are part of the network, their connectivity is weaker compared to key players. Strengthening local community engagement, conducting outreach programs, and involving NGOs in public health initiatives could improve overall healthcare service quality.

Conflicts Network Among Stakeholders

The conflict relationship network in Figure 4 highlights areas of tension and disagreement among stakeholders involved in the project. While collaboration is essential for project success, conflicts can arise due to misaligned priorities, administrative challenges, unclear roles, and differing expectations.

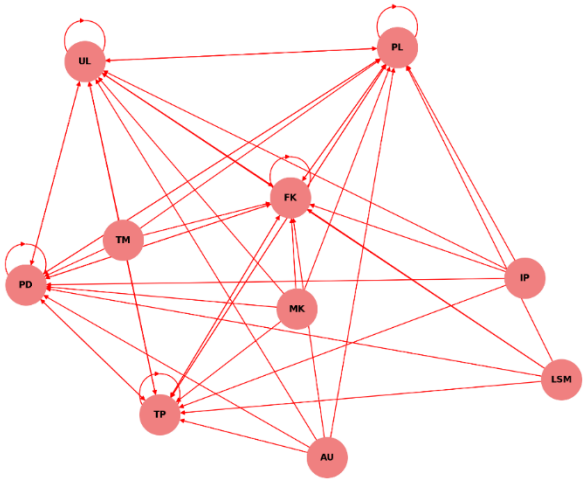

Figure 4. Social Networks of Conflict Relationship Among Stakeholders

By analyzing the network of conflicts, we can identify the main sources of stakeholder tension and propose strategies for conflict resolution. Figure 4 shows high-conflict relationships between key stakeholders, which could impact project efficiency, decision-making, and long-term sustainability.

1) Conflict Between Supporting Agencies (IP) and University Administration (AU) – Disputes Over Procurement Policies and Administrative Regulations

One of the most prominent conflicts in the network is between IP and AU. The high level of conflict between these stakeholders suggests ongoing issues related to procurement processes, financial management, and administrative regulations.

- Key Challenges
  - Procurement delays, contract disputes, and bureaucratic inefficiencies in acquiring medical equipment, laboratory resources, and hospital infrastructure.
  - Differences in expectations regarding contract transparency, pricing, and accountability, leading to tensions between university administrators and external suppliers.
  - Conflicting regulatory frameworks between university financial policies and supplier expectations, creating inefficiencies in procurement workflows.

- Potential Solutions
  - Establishing a clearer and more transparent procurement system to streamline purchasing processes, reduce bureaucratic barriers, and improve contract negotiations.
  - Strengthening dialogue between AU and IP, ensuring that procurement agreements align with university policies, financial guidelines, and supplier capabilities.
  - Implementing digital procurement tracking systems to improve transparency, efficiency, and accountability in supplier transactions.

2) Conflict Between Patients and Local Community (PL) and Project Stakeholders – Barriers to Healthcare Access

The network also highlights a strong conflict between PL and the broader project stakeholders. This tension stems from obstacles in accessing healthcare services and a lack of integration between patient needs and academic objectives.

- Key Challenges
  - Delays in hospital service availability, with the local community feeling that the teaching hospital is more focused on academic training than providing immediate healthcare solutions.
  - Concerns over affordability, service accessibility, and prioritization of patient care, particularly for underserved and low-income populations.
  - Lack of community engagement and transparency in hospital operations, resulting in public dissatisfaction and distrust in the project's implementation.

- Potential Solutions
  - Strengthening community outreach and patient engagement through public forums, town hall meetings, and healthcare accessibility programs.
  - Ensuring that hospital policies balance medical training needs with patient-centered care, improving appointment systems, service prioritization, and affordability strategies.
  - Enhancing communication between hospital administrators, government agencies, and the local population, ensuring that public health concerns are addressed alongside academic goals.

3) Conflict Between Potential Medical Personnel (TP) and Academic Institutions (FK, AU) – Disagreements Over Roles and Responsibilities

The conflict between TP and Academic Institutions (FK, AU) is another significant issue in the project. This dispute revolves around unclear roles, expectations, and responsibilities of medical students, interns, and healthcare trainees within the hospital.

- Key Challenges
  - Unclear job descriptions and training guidelines, leading to frustration among potential medical personnel regarding workload distribution, internship duties, and career pathways.
  - Disagreements over academic requirements versus clinical responsibilities, as students and trainees struggle to balance educational obligations with practical hospital duties.
  - Concerns overcompensation, employment security, and career development, with medical trainees questioning their long-term prospects in the hospital system.

- Potential Solutions
  - Defining clear job roles, responsibilities, and training pathways to ensure that medical students, interns, and healthcare trainees have structured learning experiences.
  - Establishing a Student and Trainee Committee to voice concerns, negotiate work conditions, and collaborate with academic leadership.
  - Introducing mentorship programs and professional development initiatives to help potential medical personnel transition smoothly from training to full-time employment in the hospital.

4) Addressing Conflicts Through Inclusive Cross-Sector Communication

The presence of multiple stakeholder conflicts indicates that a more inclusive, transparent, and structured communication approach is needed. Stakeholders must have a platform to express concerns, negotiate agreements, and collaborate on mutually beneficial solutions.

- Key Recommendations for Conflict Resolution
  - Establish a Stakeholder Mediation Board

A structured conflict resolution committee should be created to mediate disputes, facilitate negotiations, and develop action plans to address stakeholder concerns.

  - Improve Cross-Sector Communication

Strengthen formal communication channels between academic institutions, government agencies, healthcare providers, and the local community to ensure mutual understanding and problem-solving.

  - Promote Collaborative Decision-Making

Implement joint policy discussions, stakeholder workshops, and participatory decision-making processes to encourage shared responsibility and consensus-building.

Stakeholder Positioning Related to Environmental Sustainability

Two stakeholder categories are directly relevant to environmental sustainability: LSM (Health NGOs, which include environmental health aspects) and IP (Supporting Agencies, including waste management partners). As shown in Table 4, LSM had low power (2.40), very low interest (1.60), and zero commitment. IP had similarly low power (2.38), low interest (2.52), and low commitment (2.07). In the collaborative network (Table 5, Figure 3), LSM had a degree centrality of 0.15 and betweenness of 0.02; IP had a degree centrality of 0.35 and betweenness of 0.09. Both stakeholders are located in the Crowds quadrant of the power–interest grid (Figure 2) and occupy peripheral positions in the network.

Descriptive Patterns from SA and SNA

The following descriptive patterns are observed from the SA and SNA results:

- Pattern 1: Stakeholders with higher power and interest (FK, TM, PD, AU) also exhibited higher degree and betweenness centrality in the collaborative network. Conversely, stakeholders with low power and interest (PL, LSM, TP, IP) showed low centrality and peripheral network positions.
- Pattern 2: The conflict network is sparse, with only three reported conflict pairs. The highest intensity conflict occurred between IP and AU (procurement and administrative processes). The conflict involving PL was reported as a perception of limited healthcare access. The conflict involving TP related to role clarity and training expectations.
- Pattern 3: Environmental sustainability stakeholders (LSM, IP waste management) are positioned at the periphery, with low centrality and low power–interest scores.

DISCUSSION

This study demonstrates that combining SA and SNA offers a comprehensive framework for understanding the governance dynamics of educational hospitals, especially in contexts involving multiple sectors, regulatory layers, and sustainability considerations. The findings align with and expand upon earlier studies by[7,9,13], which suggested that understanding both stakeholder positioning and relationship networks is critical for the successful implementation of complex public projects.

The SA results (Table 4, Figure 2) show that the Faculty of Medicine (FK) and the Hospital Project Management Team (TM) have the highest power, interest, and commitment scores among all stakeholder categories. Local Government (PD) also shows high power and interest but moderate commitment. In contrast, Patients/Local Community (PL), Health NGOs (LSM), Potential Medical Personnel (TP), and Supporting Agencies (IP) have below-mean scores on all three indices, with PL and LSM reporting zero commitment.

To be detailed, at the core of the project network are the University (Faculty of Medicine/FK) and the Hospital Project Management Team (TM), both of which hold high

levels of power, interest, and commitment. Their strategic positions as decision-makers and operational lead to underscore the importance of maintaining strong institutional alignment between academic objectives and healthcare service delivery. The Health Department (PD) also plays a key regulatory role, ensuring that the hospital complies with regional health strategies and public service mandates. These findings are consistent with[13] power–interest stakeholder mapping and the typology of "players" who must be engaged closely due to their high influence and high stakes in project success.

Interestingly, the Faculty of Medicine also functions as a bridge between actors in the network, an insight reinforced by its high betweenness centrality in the SNA results. This mirrors findings[6,7], who noted that academic institutions often serve as "knowledge brokers," translating technical knowledge into policy-relevant actions and connecting otherwise fragmented stakeholders. Such positioning is critical for aligning educational, medical, and governance functions under one institutional umbrella.

While the central stakeholders are well-positioned and engaged, several supporting and peripheral stakeholders were found to have lower levels of influence and commitment. For example, the University Research and Development Division (UL), although highly interested in the project, had only moderate power and limited involvement in decision-making. This imbalance echoes findings by[1], who observed that supporting stakeholders are often overlooked in strategic planning despite their potential contributions to innovation and sustainability. Similarly, the relatively low scores and peripheral positions of Potential Medical Personnel (TP), Supporting Agencies (IP), Health NGOs (LSM), and the Local Community (PL) suggest a governance structure that is still institutionally centered, with limited horizontal engagement across sectors and social groups.

The low engagement of community actors and environmental stakeholders raises concerns, particularly considering the growing emphasis on sustainability in healthcare governance. Past studies have shown that integrating community feedback and environmental considerations into planning processes is crucial for long-term success[2,10]. In the case of project, the Environmental Agency (DLH) and health-focused NGOs are not yet fully embedded in the hospital's collaborative structure, despite their potential to influence policy development, promote public health programs, and monitor environmental compliance.

The current network structure, which concentrates collaboration among core institutional actors, reflects a vertical governance approach. The SNA results (Table 5, Figure 3) indicate that FK and TM also have the highest degree and betweenness centrality in the collaborative network, meaning they have the most direct ties and most frequently lie on shortest paths between other stakeholders. PD and University Administration (AU) also exhibit relatively high centrality. PL, LSM, TP, and IP have low degree and betweenness centrality, placing them at the network periphery.

Such an approach warned, without adequate cross-sectoral dialogue, risks institutional fragmentation and operational inefficiencies[8]. In projects where external support, such as technological infrastructure or community-based health programs, is essential, weak network connectivity can compromise sustainability. Strengthening stakeholder ties horizontally, through forums, joint initiatives, or public–private partnerships, could help balance institutional strength with community relevance and environmental responsiveness.

From a methodological standpoint, the combined SA–SNA framework proved especially valuable. As[6,9,18,19] highlighted, stakeholder analysis allows for the classification of actors based on formal power and interest, while SNA reveals relational patterns that may not be visible through positional data alone. In this study, the comparison between power–interest scores and centrality metrics highlighted discrepancies, for example, stakeholders with moderate perceived power (e.g., UL and IP) but limited actual network connectivity. Identifying such gaps is essential for designing targeted engagement strategies that are both efficient and equitable.

Implications for Health Behavior or Policy

The conflict network (Figure 4) revealed three pairs with elevated conflict intensity: (1) IP (Supporting Agencies) versus AU (University Administration); (2) PL (Patients/Local Community) versus the core group (PD, FK, TM); and (3) TP (Potential Medical Personnel) versus FK/AU. No other stakeholder pairs reported conflict above the threshold.

In addition, the findings of this study provide several implications for health behavior and policy in the context of educational hospitals and sustainable governance. Based on the above analytic findings, we offer the following interpretations and suggestions, which are not direct outputs of the metrics but are informed by them and by the qualitative interview data.

Implication 1: Centralized governance structure.

The high centrality of FK, TM, PD, and AU suggests that governance currently relies on a core of institutional actors. This configuration may support efficient decision-making during the

pre-operational phase, but it also implies that peripheral stakeholders have limited direct influence. From a policy perspective, this pattern indicates a need for deliberate mechanisms to include community and NGO voices, such as advisory panels or participatory planning forums.

Implication 2: Potential risks from peripheral stakeholder exclusion.
The low engagement of PL (patients/community) and LSM (health/environmental NGOs) may, if unaddressed, lead to reduced community trust or missed opportunities for public health and environmental monitoring. While the current data do not demonstrate any negative outcomes, the network structure is consistent with the risk that these stakeholders' interests could be overlooked during operational planning. Therefore, policy makers might consider targeted outreach and formal engagement channels.

Implication 3: Conflict sources and potential mitigation.
The observed conflict between IP (supporting agencies) and AU (university administration) is likely related to procurement and administrative processes, as reported in interviews. Similarly, the conflict between PL and core stakeholders appears to stem from concerns about healthcare access. The conflict between TP and FK/AU relates to role clarity. These conflicts are not inevitable but are reported as current perceptions. Mitigation strategies could include establishing a transparent procurement tracking system, creating a patient advisory committee, and developing clear training guidelines for medical personnel. However, these strategies are author-suggested, not empirically tested in this study.

Implication 4: Environmental sustainability integration.
The peripheral positioning of environmental stakeholders (LSM and IP waste management) suggests that sustainability considerations are not yet embedded in the core governance network. Given the hospital's planned operations, this pattern indicates an opportunity to proactively integrate environmental criteria into procurement, waste management protocols, and community health programs. The SA–SNA framework itself can serve as a diagnostic tool for monitoring whether environmental stakeholders become more central over time.

Several limitations should be acknowledged. The study included 10 stakeholder categories with one key informant per category, which, while consistent with positional SNA practice, does not capture intra-category diversity and limits generalizability to other contexts. Power, interest, and relationship measures were self-reported via Likert scales, making them vulnerable to individual bias, social desirability, or incomplete knowledge; conflict reports, in particular, reflect perceived rather than objectively verified disagreements. Centrality metrics describe node-level positions but cannot directly infer system-wide governance properties such as overall efficiency or resilience, as node-level patterns do not automatically translate to whole-system outcomes. Finally, the study focused on a single planned hospital at one pre-operational time point; findings may not apply to operational hospitals or different regulatory/cultural settings, and longitudinal data would be needed to observe network evolution.

CONCLUSIONS

This study illustrates how integrating Stakeholder Analysis (SA) and Social Network Analysis (SNA) can be applied to explore governance structures in a planned educational hospital. The findings describe a governance network in which core institutional stakeholders (Faculty of Medicine, Project Management Team, Health Department, University Administration) hold central positions, while peripheral actors (NGOs, environmental agencies, community groups) exhibit lower engagement and network connectivity. These patterns contribute to a diagnostic understanding of potential influence gaps and coordination challenges prior to hospital operations. Rather than claiming demonstrated outcomes, this study emphasizes that the SA–SNA framework can help identify structural features of governance networks that may warrant attention for inclusive and sustainability-oriented planning. The study is limited by its small stakeholder sample and single-case, pre-operational context; therefore, claims about policy effectiveness or sustainability impacts remain tentative. Future research should expand stakeholder representation, apply longitudinal designs, and conduct cross-institutional comparisons to further develop governance frameworks for educational hospitals.

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REFERENCES

1. Mushove P, Vogel C. Heads or tails? Stakeholder analysis as a tool for conservation area management. *Glob Environ Change*. 2005;15(3):184–98.
2. Tampio KP, Haapasalo H, Ali F. Stakeholder analysis and landscape in a hospital project – elements and

implications for value creation. *Int J Manag Proj Bus*. 2022;15(8):48–76.

3. Riege A, Lindsay N. Knowledge management in the public sector: stakeholder partnerships in the public policy development. *J Knowl Manag*. 2006;10(3):24–39.

4. Skjørshammer M. Co-operation and conflict in a hospital: interprofessional differences in perception and management of conflicts. *J Interprof Care*. 2001;15(1):7–18.

5. Ahmadi A, Kerachian R, Rahimi R, Emami Skardi MJ. Comparing and combining social network analysis and stakeholder analysis for natural resource governance. *Environ Dev*. 2019;32:100451.

6. Ogada JO, Krhoda GO, Van Der Veen A, Marani M, van Oel PR. Managing resources through stakeholder networks: collaborative water governance for Lake Naivasha basin, Kenya. *Water Int*. 2017;42(3):271–90.

7. Paletto A, Balest J, De Meo I, Giacovelli G, Grilli G. Power of forest stakeholders in the participatory decision-making process: a case study in northern Italy. *Acta Silv Lignaria Hung*. 2016;12(1):9–22.

8. Yang LE, Chan FKS, Scheffran J. Climate change, water management and stakeholder analysis in the Dongjiang River basin in South China. *Int J Water Resour Dev*. 2018;34(2):166–91.

9. Lienert J, Schnetzer F, Ingold K. Stakeholder analysis combined with social network analysis provides fine-grained insights into water infrastructure planning processes. *J Environ Manage*. 2013;125:134–48.

10. Dos Muchangos LS, Tokai A, Hanashima A. Application of material flow analysis to municipal solid waste in Maputo City, Mozambique. *Waste Manag Res*. 2017;35(3):253–66.

11. Franco-Trigo L, Fernandez-Llimos F, Martínez-Martínez F, Benrimoj SI, Sabater-Hernández D. Stakeholder analysis in health innovation planning processes: a systematic scoping review. *Health Policy*. 2020;124(10):1083–92.

12. Creswell JW, Clark VLP. Designing and conducting mixed methods research. Thousand Oaks (CA): Sage Publications; 2017.

13. Bryson JM, Cunningham GL, Lokkesmoe KJ. What to do when stakeholders matter: the case of problem formulation for the African American men project of Hennepin County, Minnesota. *Public Adm Rev*. 2002;62(5):568–84.

14. Likert R. Technique for the measurement of attitudes. New York: Archives of Psychology; 1932.

15. Freeman RE, McVea J. A stakeholder approach to strategic management. 2001.

16. Bonacich P. Power and centrality: a family of measures. *Am J Sociol*. 1987;92(6):1170–82.

17. Freeman LC. Centrality in social networks: conceptual clarification. *Soc Networks*. 1979;1(3):215–39.

18. Saidouni A, Ghazy RM, Zorgany A, Elahmer O, Natuh D, Osman RM, El Halafi A, and Zouiten A. Toward One Health institutionalization: harnessing stakeholder network as leverage to strengthen health security in Libya. Frontiers in Public Health. 2025;13:1651901.

19. Behzadifar M, Shahabi S, Bakhtiari A, Azari S, Teli BD, Yarahmadi M, Martini M, and Behzadifar M. Mapping the social networks of key actors in the development of health technology assessment in Iran. J Prev Med Public Health. 2025;58(2):123-31.