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Feasibility and Economic Viability of Pooling Hospital Support Functions in Public Hospitals in Benin

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Abstract

Introduction: Hospital performance depends strongly on the effectiveness of support functions, such as maintenance, procurement, and transport. In sub-Saharan African countries, where these functions are often limited, pooling has emerged as a strategy to improve productive efficiency. This study assessed the feasibility of pooling support functions across public hospitals in Benin. **Methods:** A cross-sectional, mixed-methods evaluative study was conducted among hospital managers and support-function personnel. Quantitative data were collected using a structured questionnaire and analysed using Stata 14 to assess the sub-components of feasibility. Qualitative data were gathered through interviews and subjected to thematic analysis. **Results:** Most respondents expressed positive views towards pooling, perceiving it as a lever for enhancing efficiency and service quality. Feasibility index reached 85.71% for the environmental, organisational and legal sub-components, and 100% for the socio-economic sub-component. Investment appraisal demonstrated strong economic viability (NPV = approximately USD 155,667; IRR = 24%; payback period = 6.2 years). The overall feasibility index was 88.24%, surpassing the required threshold of 85%. Key obstacles identified included limited interoperability of information systems, insufficient formal coordination frameworks, and regulatory gaps relating to transport and procurement. **Conclusion:** The convergence of the evaluated sub-components indicates that conditions necessary for the successful pooling of support functions are met in the Ouémé Department. However, project success will depend on strengthening governance, coordination mechanisms and information systems. This study offers

valuable insights for guiding hospital-system reforms and calls for further research into the operational modalities of implementing pooled support services.

Keywords

Pooling, Hospital Support Functions, Feasibility, Hospital Management, Benin

1. Introduction

Health systems worldwide are experiencing increasing pressure due to rising healthcare needs, budgetary constraints and the imperative of continuous improvement in the quality and safety of hospital services, placing organisational performance at the heart of health-sector reforms [1] [2].

In hospital settings, overall performance depends not only on clinical activities but also on the quality of management of support functions, such as equipment maintenance, procurement, and transport, which directly determine the continuity and safety of care [3]. Evidence shows that logistical and technical functions constitute a substantial share of hospital expenditure, accounting for 30% - 40% of operating costs in high-income countries, thereby representing a major efficiency lever for hospital managers [4] [5].

In low- and middle-income countries, particularly in sub-Saharan Africa, the management of hospital support functions is frequently challenged by limited financial resources, shortages of qualified personnel, weak information systems and obsolete infrastructure and equipment [6] [7].

Several studies conducted in Africa have highlighted recurrent dysfunctions in the maintenance of medical devices, characterised by a predominance of corrective maintenance, limited access to spare parts, and fragmented organisation of technical services, with direct consequences for equipment availability and quality of care [8] [9]. Similarly, supply chains and transport systems within African health services often suffer from poor coordination, frequent stockouts and logistical inefficiencies [6].

In response to these constraints, various initiatives have been implemented in different contexts to improve hospital efficiency, including the centralisation of certain functions, as observed in Kenya and Ghana [10], inter-facility cooperation, and organisational collaboration mechanisms aimed at sharing resources and expertise. In high-income countries, pooling or sharing of hospital functions has developed primarily through formal institutional frameworks, such as hospital networks or territorial groupings, with objectives of cost rationalisation, standardisation of practices and improved overall performance [11] [12]. However, these experiences are highly dependent on specific legal, organisational and financial contexts, and authors emphasise that results cannot be transposed to resource-constrained health systems without prior feasibility analysis [12] [13].

Despite growing interest in cooperation and pooling within hospital management, the scientific literature reveals a notable lack of empirical studies systematically assessing the environmental, organisational, socio-economic and legal feasibility of pooling hospital support functions in sub-Saharan Africa [12].

It is in this context that the present study was undertaken to determine the conditions required for the pooling of support functions in Benin.

Pooling of hospital support functions is herein defined as a formal agreement between autonomous public institutions aimed at sharing resources, capacities, and expertise in targeted non-clinical domains (maintenance, procurement, transport), distinct from centralisation (transfer of authority to a single entity), outsourcing (recourse to a private provider), and informal cooperation (ad hoc arrangements without legal framework).

2. Methods

2.1. Study Setting

The study was conducted in the Ouémé Department, which borders the Federal Republic of Nigeria and is administratively subdivided into nine communes and, from a health-system perspective, into three health zones (**Figure 1**).

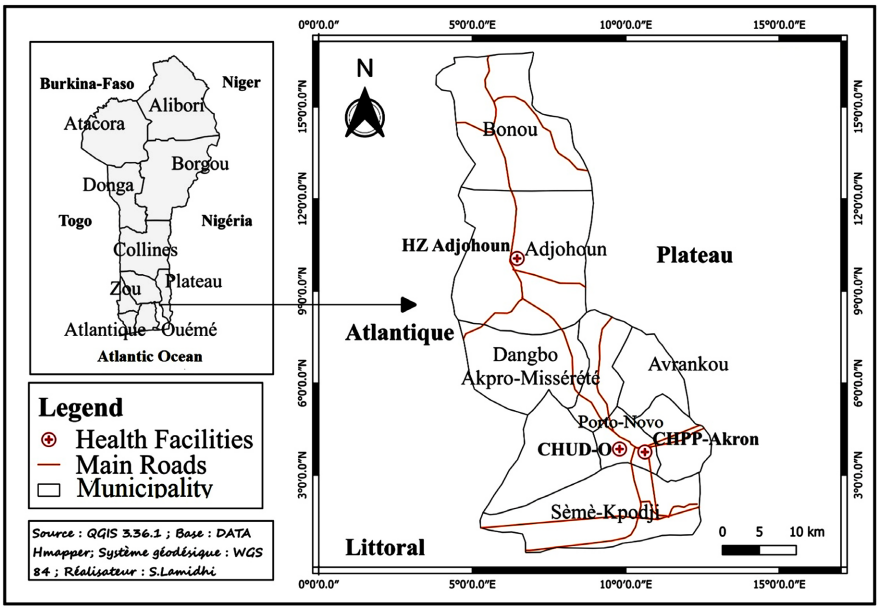

Figure 1. Map of the Ouémé department showing the location of the three public hospitals.

The hospital system of the department comprises a network of public and private facilities, including three public referral hospitals, which constitute the scope of the present study. These hospitals share similar missions in the provision of care, referral services, and support to peripheral health facilities, and they operate with comparable governance structures, human resources and support functions.

The Departmental Teaching Hospital Centre of Ouémé and Plateau (CHUD-OP) represents the highest level of the hospital pyramid within the department. It

provides specialised care and serves as the referral centre for the departments of Ouémé and Plateau, while also receiving patients from other regions of the country and from border areas. The Adjohoun District Hospital is a peripheral referral hospital responsible for managing common pathologies and medical and surgical emergencies for the population of its health zone. It plays a key role in ensuring continuity of care and in relieving congestion in higher-level hospitals. The Akron Pneumo-Phtisiology Hospital Centre (CHPP-Akron) is a specialised facility historically dedicated to the management of tuberculosis and respiratory diseases. Due to its specialised mandate and geographical location, it receives patients from several departments across the country.

These three hospitals exhibit similar support functions, particularly regarding maintenance of biomedical equipment, procurement of medical and non-medical supplies, and transport of goods and individuals. However, these functions are autonomously organised and managed within each facility, in a context characterised by resource constraints and increasing performance and efficiency requirements.

The selection of the three hospitals was justified by their functional complementarity, geographical proximity and shared administrative and health-system environment, providing a relevant and coherent study setting.

2.2. Study Participants and Eligibility Criteria

The study population consisted of actors involved in the management, supervision and execution of hospital support functions within the three selected public hospitals in the Ouémé Department. These participants included personnel working in maintenance, transport and procurement functions, as well as members of the Hospital Governance Team (HGT).

Inclusion Criteria

Participants were included if they met all the following conditions:

- Held a managerial, supervisory or operational role related to hospital support functions (maintenance, procurement, transport) in one of the study hospitals;
- Were confirmed as members of the Hospital Governance Team through an official appointment note;
- Had been in post for at least six months prior to the data-collection period;
- Provided free and informed consent to participate in the study.

2.3. Study Design

The study was a cross-sectional, evaluative investigation undertaken to assess feasibility. A mixed-methods approach was adopted, combining quantitative and qualitative methods. The quantitative component enabled the generation of feasibility index by sub-component, whereas the qualitative component explored the perceptions, experiences and constraints expressed by the actors.

All stakeholders involved in support functions (maintenance, transport and procurement) and all members of the Hospital Governance Team were included in the study.

Sample Size

As the selection of participants was exhaustive, no sample-size calculation was required. In total, 37 individuals were surveyed: 24 support-function actors and 13 members of the Hospital Governance Team.

2.4. Data-Collection Components and Tools

The main variable of interest was the feasibility of pooling hospital support functions, defined as the actual possibility of implementing a shared organisational model for these functions under existing conditions in the study hospitals.

Feasibility was assessed through four contributing sub-components:

- Environmental aspects (transport accessibility, geographical proximity of hospitals, existence and quality of communication infrastructure, interoperability of information systems, etc.);
- Organisational aspects (organisational proximity, potential for shared human resources, existence of governance bodies, etc.);
- Socio-economic aspects (actors' knowledge, opinions and perceptions; mobilisation of financial resources; affordability of investment costs, etc.);
- Legal aspects (existence of partnership agreements, health-protection legislation, legal responsibilities of institutions, etc.).

Each item or variable of the sub-components was incorporated into the questionnaire or interview guide used for data collection. The questionnaire was digitised using KoboCollect. Legal and managerial documents were also subjected to documentary review. For integrated assessment of items and sub-components, participants' responses were scored binarily, assigning 0 for a "no" or "poor" response and 1 for a "yes" or "good" response. The sum of these scores enabled calculation of the raw or relative (percentage) score for each sub-component.

2.5. Data Processing and Analysis

Data collected using digital tools via KoboCollect were processed and analysed with Stata 14. Proportions and their 95% confidence intervals were computed for quantitative data. Audio recordings of the semi-structured interviews (n = 13, conducted with all members of the HGT from the three hospitals, selected exhaustively according to eligibility criteria) were transcribed verbatim. Thematic analysis was conducted independently by two researchers following the approach of Braun and Clarke (2006). Coding discrepancies were resolved through consensus, ensuring inter-coder reliability.

Feasibility was assessed using a composite score obtained by aggregating the scores of the various evaluated sub-components. Weighted score ranges were as follows: environmental aspects (0 - 210), organisational aspects (0 - 140), socio-economic aspects (0 - 120) and legal aspects (0 - 210). For each sub-component, the score obtained was divided by the maximum theoretical score and expressed as a percentage. These scores provided an estimation of feasibility levels by sub-component.

An overall feasibility index was then calculated by aggregating the scores of the

four sub-components. In line with methods used by USAID and MESH [14], feasibility was deemed satisfactory if, and only if, both of the following criteria were met:

- Each of the four sub-component scores reached ≥75% of the expected value;
- The overall feasibility index reached ≥85% of the total expected feasibility index.

These thresholds, adapted from the USAID/MESH standards [14], make it possible to identify, in resource-limited settings, a minimum acceptable level of operational conditions without imposing unattainable requirements. The 75% threshold per sub-component ensures the absence of major structural deficiencies in each dimension, while the 85% overall threshold requires sufficient convergence of all conditions for implementation to be considered viable.

2.6. Ethical Considerations

The study was conducted with the approval of a scientific and ethics committee assembled by the Regional Institute of Public Health. Administrative authorisations were subsequently obtained from the Ministry of Health, the Departmental Health Directorate of Ouémé, and the management teams of the participating hospitals. Each participant was enrolled after providing informed consent. Anonymity and confidentiality were strictly maintained, and only aggregated data are disseminated.

3. Results

3.1. Sociodemographic Characteristics of Respondents

Of the 37 participants surveyed, 59.5% were from CHUD-OP and 29.7% from the Adjohoun District Hospital. The majority were support-function actors (64.9%) and had been in post for more than one year. Support-function personnel had, overall, greater seniority in their positions (Table 1).

Table 1. Distribution of participants by hospital, profile and length of service (n = 37).

Variables	Frequency	Proportion (%)	95% CI
Facility			
CHUD-OP	22	59.5	43.5 - 73.7
CHPP-Akron	4	10.8	4.3 - 24.7
Adjohoun District Hospital	11	29.7	17.5 - 45.8
Participant profile			
HGT Members	13	35.1	21.8 - 51.2
Support-function actors	24	64.9	48.8 - 78.2
Length of service			
<1 year			
HGT Members	1	2.7	0.5 - 13.8

Continued

Support-function actors	0	0	-
1 - 8 years			
HGT Members	10	27.0	15.4 - 43.0
Support-function actors	11	29.7	17.5 - 45.8
>8 years			
HGT Members	2	5.4	1.5 - 17.7
Support-function actors	13	35.1	21.8 - 51.2

3.2. Knowledge, Opinions and Perceptions of Actors Regarding the Pooling of Support Functions

3.2.1. Knowledge of Support-Function Pooling

Respondents provided varied definitions of pooling. For some hospital managers, pooling was perceived primarily as the grouping of disciplines and resources to improve the functioning of several health facilities simultaneously, with a focus on performance and competency strengthening:

> "Pooling support functions, for me, means bringing together all the disciplines that can be combined for the proper functioning of several facilities (…) so that we become more efficient and also update actors' knowledge." (Hospital Manager, male, 47 years)

Others viewed pooling as a more formal process rooted in inter-hospital consultation and collaboration, based on institutional mechanisms such as formal notes, correspondence and regulatory documents:

> "Pooling starts with consultation with other facilities (…) through correspondence, through notes, texts that bring two or more structures together." (Hospital Manager, male, 53 years)

Despite differences in understanding, all managers clearly recognised the importance of pooling for organisational efficiency and resource-sharing.

3.2.2. Opinions and Perceptions of Pooling

Opinions were diverse, though many hospital managers expressed strong support for pooling, considering it a strategic option with significant added value for public hospitals:

> "My opinion? I am absolutely in favour, one could even say 200%, of this pooling principle (…) for it to become a reality." (Hospital Manager, male, 53 years)

Pooling was widely perceived as a lever for optimising human, financial and material resources, improving service quality while limiting costs:

> "It is a good strategy to enable the rational use of resources and the improve-

ment of service quality (…) using fewer resources to obtain good results." (Hospital Manager, male, 58 years)

Several actors perceived pooling as a welcome initiative capable of producing outcomes beyond initial expectations, including in support functions:

"The initiative is completely welcome. Even support functions can exceed what one might expect." (Hospital Manager, male, 47 years)

Others saw pooling as aligning with government directives aimed at more rational use of public resources:

"I believe this is the government's watchword: using fewer resources to achieve greater results." (Accountant, male, 45 years)

3.3. Feasibility of Support-Function Pooling (Environmental, Organisational, Socio-Economic and Legal Sub-Components)

3.3.1. Environmental Aspects

Scores ranged from 43.30% for information-system compatibility to 100% for institutional proximity and political environment (**Figure 2**). Intermediate levels were recorded for transport accessibility (91.90%), communication networks (75.70%), geographical proximity (70.30%) and consultation frameworks (56.80%).

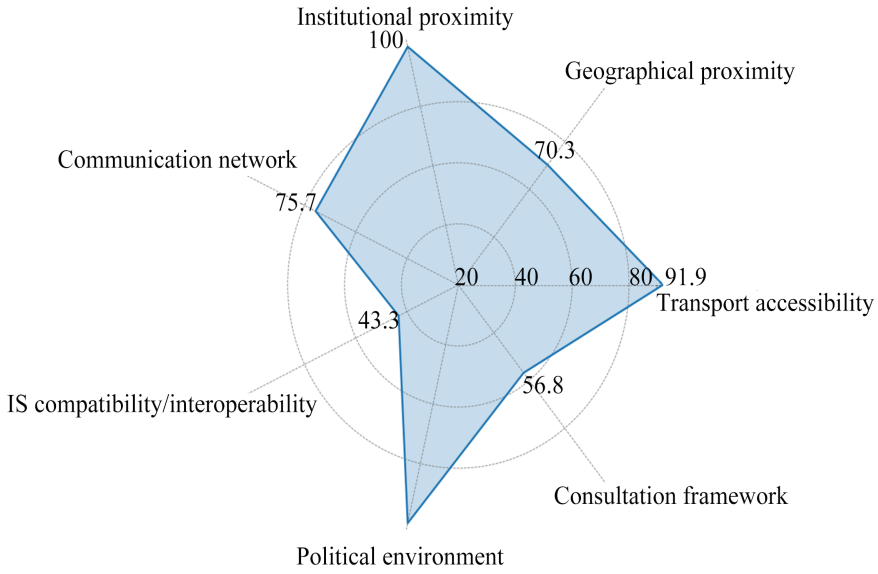

Figure 2. Assessment of the environmental aspects sub-component of the feasibility of pooling hospital support functions.

3.3.2. Organisational Aspects

Scores ranged from 0% for new acquisitions to 100% for organisational proximity, cultural proximity and new constructions (**Figure 3**). High proportions were observed for governance bodies (86.50%) and shared human-resource arrangements (76.90%), whereas the existence of a communication unit showed a more moderate score (59.50%).

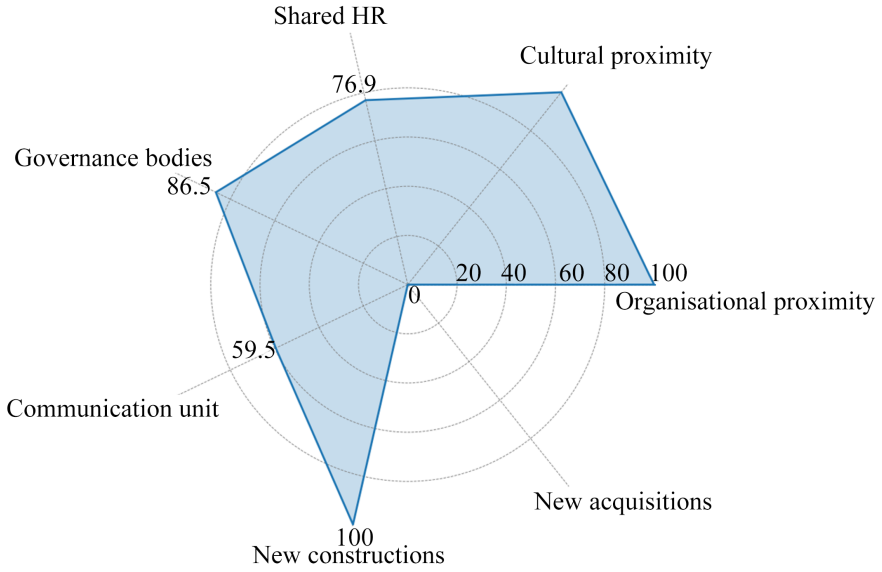

Figure 3. Assessment of the Organisational aspects sub-component of the feasibility of pooling hospital support functions.

3.3.3. Socio-Economic Aspects

This sub-component achieved a score of 100% across all assessed dimensions, including resource mobilisation, affordability of investment costs, economic gain, project viability, social impact and impact on quality of working life (**Figure 4**). This reflects clearly favourable socio-economic feasibility. This score reflects unanimous agreement among respondents on the items of the socio-economic sub-component. For perception-based items (resource mobilisation, social impact, quality of working life), each participant assigned the maximum score of 1. For economic indicators (cost accessibility, viability, economic gain), the 100% score is corroborated by the profitability analysis results (positive NPV, IRR = 24%, payback period = 6.2 years), confirming that objective viability criteria were fully met.

Investment appraisal demonstrated substantial return on investment. At a discount rate of 5.7%, the net present value (NPV) was estimated at USD 155,614, with an internal rate of return (IRR) of 24% and a monetary unit return (MUR) of 1.61. The payback period was 6 years, 2 months and 2 weeks.

The self-financing capacity increased from USD 20,686 in the first year to USD 116,519 in the tenth year, with an average value of USD 52,720 over the analysis period.

The project was also profitable from the shareholders' perspective (NPV = USD 111,052; IRR = 14%) and from the capital-investment perspective (NPV = USD 74,863; IRR = 11%), all at the same 5.7% discount rate.

Pooling was further expected to generate economies of scale and produce notable social effects, including improvements in workers' quality of life, reduced carbon footprint of the facilities, and annual reinvestment of self-financing capacity into the national economy.

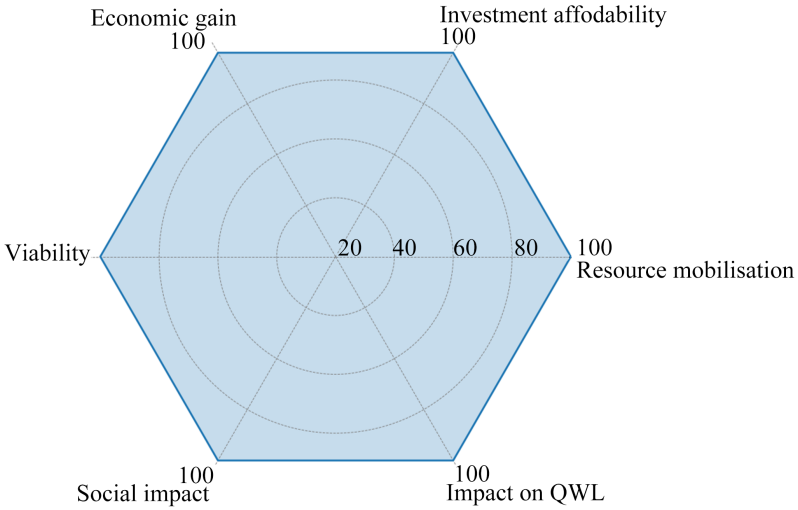

Figure 4. Assessment of the Socio-economic aspects sub-component of the feasibility of pooling hospital support functions.

3.3.4. Legal Aspects

The legal sub-component achieved a score of 100% across all variables assessed—health protection legislation, regulatory requirements for institutional coordination or pooling, legal framework, regulations concerning biomedical equipment maintenance, and quality and safety of care—except for the regulatory requirement relating to hospital transport and procurement, which scored 0% (**Figure 5**).

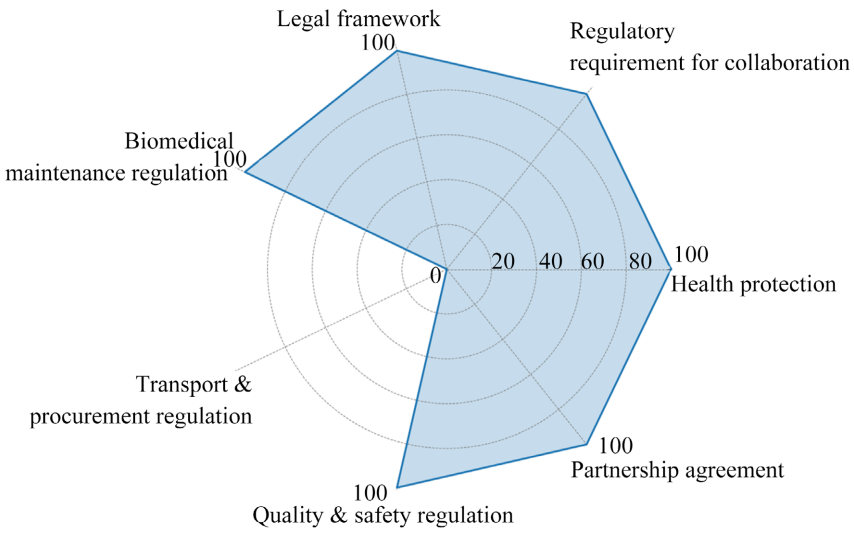

Figure 5. Assessment of the legal aspects sub-component of the feasibility of pooling hospital support functions.

3.4. Overall Feasibility Assessment

Scores for the sub-components ranged from 85.71% for environmental, organisational and legal aspects to 100% for socio-economic aspects (**Table 2**)—all exceeding the 75% threshold. The overall feasibility index was 88.24%.

Table 2. Summary of overall feasibility of pooling hospital support functions in Benin in 2023.

Sub-components	Expected Score	Actual Score	Proportion (%)
Environmental aspects	210	180	85.71
Organisational aspects	140	120	85.71
Socio-economic aspects	120	120	100
Legal aspects	210	180	85.71
Total	**680**	**600**	**88.24**

4. Discussion

4.1. Feasibility of the Sub-Components of Support Functions

The majority of actors expressed positive or highly positive opinions regarding the pooling of support functions. Such support is an important indicator of the social feasibility of this type of reform. Nevertheless, their perceptions varied, associating pooling with optimised resource use, improved overall performance and reduced redundancies. These views are consistent with the theoretical benefits expected from hospital networks or integrated health systems, such as optimising human and material resources and promoting knowledge and skills sharing [15].

The results demonstrate a high level of environmental feasibility for pooling support functions (85.71%). The high proportions observed for transport accessibility (91.90%), institutional proximity (100%) and political environment (100%) reflect a favourable context for shared inter-hospital organisation. These findings align with what Belrhiti *et al.* describe as essential prerequisites for implementing collaborative management and organisational arrangements across hospital networks, whereby institutional alignment facilitates inter-facility coordination and reduces transaction costs associated with cooperation [12]. The relatively lower proportions for geographical proximity (70.30%) and consultation frameworks with social partners (56.80%) suggest areas for improvement and highlight the need for formalised mechanisms for dialogue, the absence of which can hinder the operationalisation of public health initiatives [16]. The low compatibility of information systems (43.30%) reflects a recurrent challenge in sub-Saharan Africa, where the multiplicity of hospital information systems limits interoperability and logistical coordination, thereby hindering pooling or centralisation initiatives [6].

Organisational feasibility was also high (85.71%), driven by strong organisational (100%) and cultural proximity (100%), the presence of governance structures (86.50%) and the potential for sharing human resources (76.90%). These findings illustrate the convergence of organisational cultures and governance models, key factors in the success of hospital reforms that redistribute roles and responsibilities [1] [17]. The moderate score for the existence of a communication unit (59.50%) may indicate deficits in internal and inter-institutional communication which, according to Belrhiti *et al.*, constitute frequent barriers to the sustainability

of hospital collaborations [12]. The null score for "new acquisitions" (0%), reflecting the absence of additional investment in equipment within the planned pooling model, suggests that, in resource-limited settings, pooling strategies rely heavily on optimising existing resources [11].

The socio-economic sub-component achieved a maximum score of 100% across all variables. This strong performance reflects high social acceptability and economic viability, supported by investment appraisal. Profitability indicators (positive NPV of USD 155,614; IRR of 24%; MUR of 1.61; payback period of 6 years) confirm the economic soundness of the project. These results reinforce the contribution of pooling logistical and technical hospital functions to improved allocative efficiency and economic performance [3] [18]. The growth in self-financing capacity over the analysis period stems from efficiency gains generated through hospital reorganisation, which, when reinvested in the health system, strengthen its medium- and long-term sustainability [16]. As with all organisational reforms focused on efficiency, the expected social impact, particularly on quality of working life and environmental footprint, contributes to enhanced well-being among health professionals and increased overall hospital-system performance [2].

The high score for the legal sub-component (85.71%) stems from the presence (100%) of variables relating to health protection, legal frameworks, quality and safety of care, and partnership agreements. This reflects the existence of an enabling regulatory environment essential for securing and sustaining inter-hospital collaborations [12]. In contrast, the null score for regulatory requirements relating to transport and procurement represents a regulatory gap also identified in southern and eastern Africa as a major barrier to the integration of hospital supply chains [19].

4.2. Overall Assessment of Feasibility

The overall feasibility index (88.24%), which exceeds the threshold of 85%, together with sub-component scores, indicates that the conditions necessary for pooling hospital support functions are met in the study context. This convergence across environmental, organisational, socio-economic and legal dimensions aligns with the expectations of multidimensional assessments required before any major organisational reform [2] [16] [20].

Despite successful examples of pooling, such as the centralisation of biomedical maintenance in Rwanda, which extended equipment lifespan and reduced repair costs through centralised repair centres, the transition from perceived feasibility to actual effectiveness remains a major challenge [21]. Failures of pooling initiatives often stem from unreliable supply chains for spare parts and shortages of specialised technical personnel [8] [22]. Weak information systems, common in Benin and many African countries, further contribute to such failures by limiting the coordination required for shared services and generating transaction costs that exceed the anticipated savings [23] [24]. In summary, success in Ouémé will depend less on initial acceptance and more on the capacity to establish transparent

governance and an integrated information system that maintains trust among participating institutions. Indeed, public hospitals function as complex adaptive systems in which organisational reforms interact with multiple institutional, professional and environmental factors simultaneously [20], making sustained stakeholder engagement and adaptive governance mechanisms essential prerequisites for any pooling initiative.

Translating these findings into prerequisites for a pilot project implies three priority actions. First, information systems interoperability (43.3%) requires, at minimum, the adoption of a common data framework and a shared platform for monitoring assets and stocks before operational launch. Second, consultation frameworks (56.8%) must be formalised through inter-institutional agreements or joint steering committees with explicit mandates. Third, the regulatory gap concerning health transport and procurement (0%) requires prior adoption of a regulatory instrument or ministerial directive governing these pooled activities. These three conditions constitute the minimum roadmap for transforming observed feasibility into effective implementation.

4.3. Limitations of the Study

This study has certain limitations. The limited number of hospital sites and their location within the same department restrict the generalisability of the findings to the broader hospital system of Benin. The cross-sectional design does not allow assessment of changes in feasibility indicators over time. Nonetheless, the methodological rigour, mixed-methods approach and exhaustive inclusion of actors support the internal validity of the findings, which provide useful evidence for decision-making.

5. Conclusion

This study assessed the pooling of hospital support functions using a comprehensive approach that considered organisational, legal, socio-economic and environmental aspects. While overall feasibility was found to be favourable in the department, the study revealed that the success of pooling depends as much on institutional frameworks as on the commitment and engagement of the actors involved. The findings offer valuable insights for managers and policymakers and pave the way for future research on the practical implementation and successful scaling of pooling in public hospitals.

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Author Contributions

All authors contributed to the development of this manuscript and approved the final version.

Conflicts of Interest

The authors declare no conflict of interest.

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