

## The impact of the digitalisation of administrative services on the performance of hospital administration: The case of the Hôpital du Cinquantenaire in Kisangani

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### ABSTRACT

The digitalisation of administrative functions represents a potential driver for improving hospital governance, but its effects remain insufficiently documented in Kisangani. This study aims to analyse the relationship between the level of digitalisation of administrative services and the performance

of the administration at the Hôpital du Cinquantenaire in Kisangani. This paper presents a methodological model based entirely on data and should not be presented as field research findings. The model employs a mixed-methods cross-sectional study involving 120 staff members, supplemented by semi-structured interviews. Digitalisation and performance are measured using Likert scales, then analysed using descriptive statistics, Pearson's correlation and simple linear

regression. In the simulation, the average digitalisation score is 3.52 out of 5 and the average performance score is 3.94 out of 5. A strong positive association emerges between the two variables ( $r = 0.829$ ;  $p < 0.001$ ), with digitalisation accounting for 68.7 per cent of the variance in performance. The average administrative processing time fell from 17.8 to 8.1 minutes, representing a reduction of 53.9 per cent. The verbatim comments mainly highlighted speed, traceability and data quality, whilst also pointing out power cuts, network instability, double data entry and insufficient training. These results suggest that integrated, secure and properly supported digitalisation could improve administrative performance. It should also take into account the perceptions of patients and department heads. A proper survey, with verifiable data and multivariate analysis, remains essential before any conclusions can be drawn regarding the hospital under study.

**Keywords:** Digitalisation; Hospital administration; Performance; Information system; Kisangani.

## 1. Introduction

The digitalisation of hospital administrative services is not merely a matter of replacing paper records with computers. It involves a transformation of working methods, information flows and decision-making mechanisms. It may cover patient identification and admission, appointment management, billing, cashier's office, insurance, medical records, stock management, human resources, payroll, archives, the production of statistics and the preparation of reports.

When carried out effectively, this transformation should enable hospital administration to access information more quickly, reliably and easily. It can also reduce duplicate data entry, lost documents, billing errors, processing delays and certain opportunities for fraud. However, the presence of software does not automatically guarantee improved performance. The outcomes depend on the quality of the system, its effective use, staff skills, the availability of electricity and internet connectivity, the interoperability of applications, and management commitment.

Globally, digitalisation has gradually become one of the main drivers of modernisation in healthcare institutions. In countries with relatively well-developed healthcare systems, hospitals use integrated information systems linking patient records to admissions, the laboratory, the pharmacy, imaging, billing, accounting, human resources and management dashboards. The flow of information therefore no longer depends exclusively on physical records or informal exchanges between departments.

The World Health Organisation regards digital health as a means of making health systems more efficient, sustainable, equitable and people-centred. However, its global strategy recommends that technological investments be accompanied by appropriate governance, sustainable funding, skilled staff and standards ensuring data security and interoperability (World Health Organisation [WHO], 2021). This guidance has been extended until 2027 by the World Health Assembly. In 2025, the WHO reported that 129 countries already had a national digital health strategy in place, reflecting the importance now attached to this transformation (WHO, 2025).

In hospital administration, the expected benefits are multifaceted. Firstly, digitalisation facilitates patient identification and the traceability of their care journey. Secondly, it reduces the time spent searching for, transmitting and filing documents. Thirdly, it can improve billing by linking services provided to the procedures actually recorded. Fourthly, it enables managers to monitor revenue, expenditure, stock levels, bed occupancy, patient movements and the productivity of different departments almost in real time. Finally, it has the potential to enhance transparency and accountability, as each transaction can be linked to a date, a department and a user.

The available scientific findings are generally favourable, but they call for a measured interpretation. In their review of the literature, Uslu and Stausberg (2021) found that cost reductions were reported in 9 out of 16 studies, whilst improvements in quality were observed in 14 out of 18 studies. For their part, Modi and Feldman (2022) linked electronic records to faster documentation, better coordination, increased productivity and, in certain contexts, a reduction in missed appointments.

However, these findings do not mean that all digitisation immediately yields cost savings. Nguyen et al. (2022) point out that digital transformations in hospitals are costly, often complex and sometimes take longer than anticipated. Initial investments include the purchase of hardware, the development or acquisition of software, data security, training, maintenance and the reorganisation of processes. In several institutions, a transitional phase of duplication of effort arises when staff must simultaneously complete the electronic record and maintain the paper record.

Success therefore depends less on the sophistication of the software than on its adaptation to the institution's actual needs. A review of 27 research syntheses showed that the key success factors for a national electronic health record system are technological, human, organisational, financial, legal and ethical in nature. User involvement, training, leadership,

technical support and change management are particularly crucial (Fennelly et al., 2020).

Globally, the current state of knowledge therefore leads to a nuanced conclusion: digitalisation has real potential to improve administrative performance, but this potential only becomes a reality when the digital tool forms part of a coherent transformation of the organisation of work.

In Africa, digital health is making significant progress, notably through national health information systems, mobile applications, telemedicine, electronic health records and epidemiological surveillance platforms. One of the most visible advances has been the adoption of DHIS2 in more than 40 African countries. This platform has gradually replaced some of the manual health reporting and facilitated the production of dashboards at national, provincial and local levels (Victor et al., 2023).

However, progress in this area remains uneven. In some countries, relatively integrated systems enable the monitoring of patients and hospital resources. In others, digital tools remain limited to certain programmes funded by partners, such as vaccination, HIV, tuberculosis or epidemic surveillance. As a result, there may be several applications within the same facility without any real communication between them. This proliferation of isolated tools creates ‘digital silos’ and sometimes forces staff to enter the same information multiple times.

The report by Bataliack et al. (2024) shows that many African health data systems remain focused on specific diseases or programmes. This situation hinders the creation of an integrated system capable of simultaneously covering the clinical, administrative, financial, logistical and decision-making aspects of hospital operations. In other words, the continent is making progress in digital data collection, but the full integration of hospital administration remains inadequate.

A recent analysis of African strategies confirms this situation. Of the 54 countries examined, 48 had a plan registered with the Global Digital Health Monitor. However, an in-depth analysis of 11 recent strategies revealed weaknesses in terms of contextualisation, funding, human resources, the legal framework and interoperability. Of 148 planned interventions, 45 per cent were primarily aimed at service providers, compared with just 7 per cent that were directly targeted at service users (Sylla et al., 2025).

In the African context, however, digitalisation can address several recurring challenges faced by hospitals: slow admissions, scattered records, queues, identification errors,

stock shortages, inadequate financial monitoring, poor traceability of revenue and delays in the submission of reports. It can also improve the availability of the information managers need to allocate staff, plan purchases and monitor the use of medicines.

However, the obstacles remain considerable. These include, in particular, unreliable electricity supplies, the cost of internet access, inadequate equipment, a shortage of technicians, limited IT skills, resistance to change, the absence of common standards and insufficient maintenance budgets. Added to this are risks relating to data confidentiality, unauthorised access, loss of information and cyber-attacks.

The African experience therefore shows that digitalisation should not be viewed as a purely IT project. It is an organisational project requiring the involvement of senior management, administrators, healthcare professionals, IT s and patients. Without this involvement, the hospital risks acquiring software that is underused, ill-suited or abandoned once external funding comes to an end.

The Democratic Republic of the Congo has launched several initiatives aimed at modernising its health information system. The country has adopted the *National Plan for the Development of Health Information Technology 2020–2024*, commonly known as PNDIS II. This document defines digital health as a tool to support governance, universal health coverage and the improvement of service quality. In particular, it advocates the establishment of a coherent architecture, the integration of different platforms, the training of staff and the strengthening of data security (Ministry of Public Health, 2020).

The DRC also uses DHIS2 for the collection, transmission and analysis of health data. This platform has helped to improve the reporting of certain indicators from health zones up to provincial and national levels. However, DHIS2 remains primarily a tool for managing aggregated data and reporting. Its use does not necessarily mean that each hospital’s internal administrative processes — admissions, cashier’s office, billing, records, stock management, human resources and accounts — are fully computerised.

In 2022, the Ministry of Health and its partners adopted an investment roadmap aimed at standardising platforms, training staff and further computerising healthcare facilities. This initiative included, in particular, the training of 20,000 additional staff, the computerisation of 3,400 health centres and the improvement of internet access across the 516 health zones. However, PATH also noted that data utilisation and

feedback mechanisms remained weak and varied across health zones (PATH, 2022).

One of the major problems in the DRC is the fragmentation of initiatives. Some hospitals use an electronic health record system, whilst others rely solely on software for point-of-sale, billing, pharmacy or laboratory functions. In many cases, these tools do not communicate with one another or with national platforms. This situation results in a mix of digital documents, paper records, Excel spreadsheets and handwritten reports. It can increase staff workload rather than reduce it.

Infrastructural constraints exacerbate these difficulties. In 2024, approximately 19.7 per cent of the Congolese population used the internet, according to data from the International Telecommunication Union. Furthermore, national access to electricity remained at just over 22 per cent. Whilst these national indicators do not directly reflect the situation in each individual hospital, they illustrate the environment in which hospital systems must operate (International Telecommunication Union, 2026; World Bank, 2024).

In this context, the effectiveness of a digital hospital system depends on tailored solutions: offline operation, local and remote backups, alternative energy sources, preventive maintenance, ongoing training and available technical support. A system that requires a constant internet connection or rare expertise is likely to be unsustainable.

Digitalisation can nevertheless provide a relevant response to several challenges facing Congolese hospital administration. It can help to secure revenue, reduce untraceable payments, reconcile cash desk data with that of the pharmacy and laboratory, monitor stock levels, track staff attendance and speed up the production of reports. It can also enhance staff accountability by recording transactions carried out in the system.

However, there are still few Congolese empirical studies that directly measure the effect of digitalisation on indicators such as waiting times, billing lead times, error rates, the completeness of patient records, revenue collection, patient satisfaction or the speed of report transmission. This gap justifies conducting studies in facilities that have already embarked on a digital transition.

In Tshopo Province, the digital transformation of healthcare must be viewed within a context characterised by geographical vastness, travel difficulties, uneven availability of electricity and internet connectivity, and the concentration

of specialist resources in Kisangani. These constraints make digitalisation both difficult and necessary.

The Provincial Health Directorate and the health zones participate in the national system for the collection and transmission of health data. However, this integration into the national system does not allow us to conclude that all hospitals in the province have integrated administrative systems. The electronic collection of health indicators and the complete digitisation of hospital administration represent two different levels of digital maturity.

Public information and scientific publications specifically concerning the administrative digitisation of hospitals in Tshopo remain scarce. This scarcity of documentation is itself a significant finding of the assessment: digital projects are sometimes announced or rolled out without an independent evaluation measuring their actual usage rates, sustainability, costs and impact on performance.

In Tshopo, digitalisation could particularly improve the transmission of reports between hospitals, health zones and the Provincial Health Division. It could also facilitate the monitoring of medicines, equipment, staff, medical referrals and financial activities. However, its sustainability requires an organisation adapted to provincial realities: backup power, local maintenance, software that can be used offline and staff training.

The challenge is therefore not merely to install computers in healthcare facilities. It is a question of determining whether this equipment actually enables work to be organised more effectively, produces reliable information, reduces delays and supports the decision-making of hospital managers.

Kisangani is the main administrative, economic, academic and healthcare centre of Tshopo. The city is home to several major facilities, including the Kisangani University Clinics, the Makiso General Referral Hospital and the Cinquantenaire Hospital. It therefore provides an ideal setting for analysing the progress of hospital digitalisation in the province.

The Hôpital du Cinquantenaire in Kisangani occupies a special position due to its role as a centre of excellence and the standard of its facilities. According to the supplier DMI Afrique, the hospital has been using an electronic health record system since 2017. The same source also mentions that the Saint-Gaspard Polyclinic in Kisangani has been using an EHR system since 2020 (DMI Afrique, n.d.). This information confirms the existence of digital initiatives in the city, but it provides no independent measure of their impact on administrative performance.

Indeed, having an electronic health record system does not automatically mean that all administrative departments are integrated. It remains to be determined whether the system actually covers admissions, billing, cashier's office, archives, human resources, pharmacy, stock management and statistical reports. It is also necessary to verify whether the various departments share a common database or whether they continue to use paper records and isolated files in parallel.

The real scientific issue is therefore no longer simply whether or not a digital tool exists. It is a question of determining to what extent this tool is used and whether it produces a measurable improvement. At the Hôpital du Cinquantenaire in Kisangani, the benefits of digitisation should be assessed using concrete indicators: the time taken to register a patient, the time taken to locate a medical record, the time taken to produce invoices and reports, the frequency of errors, the traceability of revenue, the availability of information, staff satisfaction and patient satisfaction.

This evaluation must also examine the difficulties encountered by users: power cuts, network outages, insufficient workstations, slow software, lack of training, password sharing, absence of backups, resistance to change, or the continued use of both paper and digital records.

In this respect, the Hôpital du Cinquantenaire is a particularly relevant case study. It has a sufficiently long history of digital adoption to allow for an assessment, but the available data do not yet enable us to determine whether this experience has resulted in a sustainable improvement in administrative performance.

### 1.1. Background and rationale for the study

Digital transformation now plays a central role in the modernisation of healthcare organisations. In a hospital, it is not limited to the purchase of computers or the conversion of a few paper documents into electronic files. It involves a reorganisation of work processes and the gradual integration of functions such as reception, patient identification, records management, appointment booking, billing, cashier services, archives, human resources, accounting, procurement, stock management and report generation.

The World Health Organisation regards digital health as a means of making health systems more efficient, equitable, sustainable and people-centred. However, to deliver the expected results, digital technologies must be supported by clear governance, skilled staff, reliable infrastructure and appropriate data protection mechanisms (World Health Organisation [WHO], 2021).

In hospital administration, digitalisation can help reduce the time spent on data entry and searching for information. It can also improve the traceability of financial transactions, minimise duplicate data entry, reduce certain billing errors, secure records and facilitate the flow of information between different departments. Managers can thus have access to up-to-date dashboards on patient numbers, revenue, expenditure, stock levels, bed occupancy and unit productivity.

Scientific data shows, however, that the benefits of digitisation are not always automatic. In their review of the literature, Uslu and Stausberg (2021) found that cost reductions were reported in 9 out of 16 studies and that improvements in quality were observed in 14 out of 18 studies. Modi and Feldman (2022) also linked the use of electronic records to better documentation, improved coordination and increased productivity. However, success depends heavily on user engagement, training, management support, the quality of the software and its adaptation to the facility's actual processes (Fennelly et al., 2020).

In the African Region, many countries have adopted digital health strategies and use DHIS2 for the collection and analysis of health data. Despite this progress, systems often remain fragmented. Tools for surveillance, laboratory testing, pharmacy management, billing and patient management do not always communicate with one another. Challenges relating to electricity, the internet, funding, maintenance, training and interoperability also limit their sustainable use (Victor et al., 2023).

In the Democratic Republic of the Congo, the *2020–2024 National Plan for the Development of Health Information Technology* has set out the guidelines for establishing a coherent, secure and interoperable digital system. Despite the existence of this policy, digitalisation remains unevenly developed across healthcare facilities. Some facilities have an electronic health record system, whilst others continue to rely mainly on paper-based registers, Excel spreadsheets or stand-alone applications (Ministry of Public Health, 2020).

The national roadmap adopted in 2022 placed particular emphasis on the standardisation of platforms, staff training, the linking of health zones and the integration of digital tools. It also noted that data utilisation and feedback mechanisms remained weak and varied across health zones (PATH, 2022).

In Tshopo Province, and more specifically in the city of Kisangani, few studies have assessed the impact of digital technologies on the administrative performance of hospitals. According to information published by the supplier DMI Afrique, the Hôpital du Cinquantenaire in Kisangani has been

using an electronic health record system since 2017 (DMI Afrique, n.d.). The relatively long-standing presence of this digital tool provides a relevant opportunity to assess its actual use and its contribution to hospital administration.

However, the mere existence of software does not, in itself, prove an improvement in performance. It remains necessary to determine which services have actually been digitised, the degree of integration of the modules, the frequency of use of the system, and the changes brought about in terms of work speed, data reliability, financial traceability, the quality of reports and user satisfaction.

This study is therefore justified by the need to produce local empirical data on the outcomes of digitalisation. From a scientific perspective, it will help to address the lack of research on the digital transformation of hospital administrations in Tshopo. From a managerial perspective, it will enable hospital management to identify achievements, shortcomings and necessary improvements. From a social perspective, a faster and more reliable administrative system could improve the patient experience by reducing waiting times, errors and unnecessary journeys between departments.

## **1.2. Research Question**

Hospital administration serves as the coordination centre for a healthcare facility's human, financial, material and information resources. Its performance directly influences the functioning of clinical departments. A slow admission process, an incorrect invoice, a missing file, a stock shortage or a report submitted late can disrupt the patient's journey and reduce the overall quality of service.

In a largely manual system, information is often kept in multiple registers and physically passed from one department to another. This way of working can lead to lost documents, duplicates, difficulties in retrieving information, transcription errors and delays in report production. It can also reduce management's ability to access reliable information quickly for decision-making.

Digitisation should, in theory, provide a solution to these difficulties. A well-designed system can automatically record procedures, centralise data, facilitate searches and generate management indicators. However, it can also create new problems when poorly implemented: frequent system crashes, slowness, insufficient workstations, password sharing, failure to back up data, lack of training and the simultaneous maintenance of both paper-based and digital procedures.

At the Hôpital du Cinquantenaire in Kisangani, the reported use of an electronic health record system since 2017 suggests

the existence of significant digital experience. However, the available information does not allow for a precise assessment of the extent of this digitalisation. It is not sufficiently clear whether all administrative departments are integrated, whether staff regularly use the available features, and whether the data produced effectively supports management decisions.

Similarly, there is no accessible independent evaluation to confirm that digitisation has reduced registration times, billing errors, the loss of files or delays in the production of reports. The effects on staff productivity, financial transparency, inter-departmental coordination and user satisfaction also remain insufficiently documented.

The key issue addressed by this study therefore lies in the potential gap between the availability of a digital tool and the actual improvement in administrative performance. This gap may be influenced by the quality of the infrastructure, users' skills, training, leadership, technical support, data security and the level of integration between the various modules.

It is therefore necessary to assess not only the presence of technologies, but also their adoption and their concrete effects. This research will seek to establish whether the level of digitalisation observed at the Hôpital du Cinquantenaire in Kisangani is associated with a measurable improvement in the efficiency, reliability, transparency and quality of administrative services.

## **1.3. Research questions**

### **1.3.1. Central question**

To what extent does the digitalisation of administrative services influence the performance of the administration at the Hôpital du Cinquantenaire in Kisangani?

### **1.3.2. Specific questions**

1. What is the level of digitalisation of the various administrative services at the Hôpital du Cinquantenaire in Kisangani in terms of the availability, use, integration and security of digital tools?
2. What is the level of performance of the hospital's administration in terms of the speed of operations, data reliability, productivity, financial traceability, the quality of reports and user satisfaction?
3. What is the relationship between the level of digitalisation and administrative performance, and

what human, organisational and technical factors influence this relationship?

## **1.4. Research hypotheses**

### **1.4.1. Central hypothesis**

The digitalisation of administrative services is expected to have a positive and statistically significant influence on the administrative performance of the Hôpital du Cinquantenaire in Kisangani.

### **1.4.2. Specific hypotheses**

1. A high level of automation and effective use of digital tools is associated with a reduction in processing times, administrative errors and difficulties in retrieving information.
2. The integration of digital modules for admissions, billing, cashier services, medical records, stock management and reporting would improve data reliability, inter-departmental coordination, financial traceability and decision-making.
3. Staff training, the availability of electricity and network connectivity, technical support, data security and management commitment would reinforce the positive impact of digitalisation on administrative performance.

## **1.5. Objectives of the study**

### **1.5.1. General objective**

To assess the impact of the digitalisation of administrative services on the performance of the administration at the Hôpital du Cinquantenaire in Kisangani.

### **1.5.2. Specific objectives**

1. To assess the level of digitalisation of administrative services, taking into account the availability, accessibility, usage, integration and security of digital tools.
2. To measure the level of performance of the hospital's administration based on speed, productivity, data reliability, traceability of operations, quality of reports and user satisfaction.
3. To analyse the relationship between digitalisation and administrative performance, as well as the

influence of human, organisational and technical factors on this relationship.

## **2. Materials and methods**

### **2.1. Study framework**

#### **2.1.1. Overview of the Hôpital du Cinquantenaire in Kisangani**

The study will be conducted at the Hôpital du Cinquantenaire in Kisangani, situated in the city of Kisangani, the capital of Tshopo Province, in the Democratic Republic of the Congo. This public hospital was built to mark the fiftieth anniversary of the country's independence and became operational in 2013.

The hospital was designed to provide specialist care for the population of Kisangani and the surrounding areas. It comprises four major clinical departments: internal medicine, surgery, paediatrics and obstetrics and gynaecology. It also has specialist and medical-technical departments, including A&E, anaesthesia and intensive care, the laboratory, medical imaging, the pharmacy, physiotherapy, dermatology and venereology, and dentistry.

The Hôpital du Cinquantenaire is of particular interest for this study due to its level of equipment and its experience in using an electronic health record system. The solution provider states that the EHR has been in use there since 2017. This information will, however, need to be supplemented by internal documents and observations made in the field.

#### **2.1.2. Functional overview of administrative services**

The hospital's administration falls under the responsibility of the management and comprises several units contributing to the day-to-day running of the establishment. For the purposes of this study, administrative functions will be grouped into the following departments:

- Management and general administration;
- Patient reception, check-in and admission;
- Archives and management of medical records;
- Billing, cashier's office and debt collection;
- Accounting and financial management;
- Human resources management;

- Procurement, purchasing and stock management;
- Pharmacy and healthcare product management;
- Statistics, planning and reporting;
- It and system maintenance;
- Secretarial and records management;
- Medical-technical units using administrative data.
- A retrospective literature review of reports, registers, invoices, till records and system data;
- Structured observation of how the services operate;
- Semi-structured interviews with managers and key users.

From a functional perspective, the patient's administrative journey generally begins with their identification and admission. The prescribed services are then recorded, invoiced and paid for before being carried out by the relevant departments. The information generated feeds into medical records, the health insurance fund, accounts, statistics and management reports.

Digitisation should enable these various units to share information via a common system. However, the study will verify whether this integration is actually operational or whether certain departments continue to operate using paper records, parallel files or disconnected applications.

The final description must be aligned with the official organisation chart and the up-to-date list of services provided by the hospital management.

## 2.2. Methods

### 2.2.1. Type and scope of the study

This will be an evaluative case study using a mixed-methods approach. The main component will consist of a quantitative, observational and cross-sectional analytical study. This will enable the simultaneous measurement of the level of digitisation, administrative performance and the relationship between these two variables.

The cross-sectional nature of the study means that the main data will be collected from participants over a specified period. This design is suitable for studying practices, perceptions and associations between several variables, but it does not, on its own, allow for the establishment of definite causality (Setia, 2016). In the results, it will therefore be appropriate to refer to 'association' or 'statistical influence' rather than definitively proven causality.

The quantitative component will be supplemented by:

Where reliable data are available, indicators relating to comparable periods before and after digitisation or the introduction of a particular module may be examined. This documentary comparison will strengthen the study's ability to assess the changes attributable to the digital system.

### 2.2.2. Study period

The study will take place during the period from [month and year] to [month and year]. Active data collection may take between four and eight weeks.

For the documentary analysis, it is recommended that at least the twelve months preceding the data collection be examined. Where the records are sufficiently comprehensive, two comparable periods may be selected in order to examine trends in the key administrative indicators.

### 2.2.3. Study population

The target population will consist of all hospital staff involved in the production, recording, processing, use or supervision of administrative and digital information.

The accessible population will include, in particular:

- Members of senior management;
- Administrators and managers;
- Reception and admissions staff;
- Billing and cashier staff;
- Accountants and finance staff;
- Human resources managers;
- Archivists and medical records clerks;
- Statisticians and planners;
- It specialists and systems technicians;
- Pharmacy, procurement and stock managers;

- Heads of medical technology departments;
- Doctors and nurses who use the system regularly;
- Supervisors and unit managers.

The data set will consist of administrative reports, till journals, files, invoices, admission registers, stock records, statistics, financial reports and electronic logs produced during the selected period.

#### 2.2.4. Inclusion criteria

The following will be included in the study:

- Staff working in one of the departments concerned;
- Staff with at least six months' service at the establishment;
- Staff who use or directly supervise a digital tool;
- Staff present during the data collection period;
- Individuals who have given their free and informed consent;
- Administrative documents relating to the period under review and containing sufficiently comprehensive information.

#### 2.2.5. Criteria for non-inclusion or exclusion

The following will not be included:

- Trainees and occasional visitors;
- Staff with less than six months' service;
- Staff members who were absent for the entire data collection period;
- Staff not involved in the administrative processes under study;
- People who refuse to take part;
- Highly incomplete questionnaires;
- Documents that are illegible, cannot be verified or are insufficiently completed.

## 2.3. Sampling

### 2.3.1. Sampling for the quantitative component

Before determining the sample size, the researcher must obtain from the human resources department the exact number of staff members meeting the inclusion criteria.

If this number is small and readily available, a census survey will be the preferred option. All eligible staff will then be invited to take part. This approach is particularly suitable for a study conducted within a single organisation, as it improves the representation of small departments such as IT, archives or statistics.

If the population is large, the initial sample size can be calculated using Cochran's formula:

$$n_0 = \frac{Z^2 p(1-p)}{d^2}$$

Where:

- $n_0$  represents the initial sample size;
- $Z = 1.96$  for a 95 per cent confidence level;
- $p = 0.50$ , in the absence of a known proportion;
- $d = 0.05$ , corresponding to a margin of error of 5 per cent.

With these parameters, the initial sample size is approximately 384 participants. When the total population  $N$  is less than 10,000 people, the correction for a finite population must be applied:

$$n = \frac{N \times n_0}{N + n_0 - 1}$$

A 10 per cent allowance may be added to compensate for refusals and unusable questionnaires:

$$n_f = \frac{n}{1 - 0.10}$$

The final sample size can therefore only be specified once the official number of eligible staff has been obtained. The sample calculation must remain consistent with the project proposal, the planned analyses and the actual size of the population (Charan & Biswas, 2013).

### 2.3.2. Participant selection method

Where a census is not possible, proportional stratified random sampling will be used. The departments will constitute the different strata: administration, admissions, billing, cashier's office, accounts, human resources, archives, pharmacy, logistics, statistics, IT and user services.

The number of participants to be selected from each department will be calculated as follows:

$$n_i = \frac{N_i}{N} \times n$$

Where:

- $n_i$  represents the number of participants to be selected from the department;
- $N_i$  corresponds to the number of eligible staff in the department;
- $N$  represents the entire eligible population;
- $n$  corresponds to the total sample size.

Within each stratum, participants will be selected by simple random sampling from the staff lists.

### 2.3.3. Sampling for the qualitative component

Participants for the interviews will be selected using purposive sampling. The researcher will select individuals with specific experience of digitalisation and administrative processes.

Between 8 and 15 key informants may be interviewed, including:

- The medical director;
- The director or head of administration;
- The finance manager or accountant;
- The head of human resources;
- The IT manager;
- The admissions or billing manager;
- The records manager;
- The pharmacy or logistics manager;

- A medical manager;
- A nursing manager.

The final number will depend on saturation, which is reached when further interviews no longer yield substantially different information.

### 2.3.4. Selection of documents

Monthly administrative reports may be examined in full if only a limited number are available. For individual files, invoices and transactions, systematic sampling may be applied on the basis of a chronological list.

The selection interval will be calculated using the formula:

$$k = \frac{N_d}{n_d}$$

where  $N_d$  represents the total number of available documents and  $n_d$  the number of documents to be analysed. After randomly selecting the first document, every  $k$ -th document will be retained.

## 2.4. Study variables

### 2.4.1. Independent variable

The independent variable will be the level of digitisation of administrative services. It will be measured in terms of:

- The availability of IT equipment;
- The number of computerised services;
- The functional scope of the software;
- Frequency of use;
- The integration of the various modules;
- The accessibility and availability of data;
- The quality of the connection and the electricity supply;
- Security, confidentiality and data backup;
- User training;
- Technical support and maintenance.

#### 2.4.2. Dependent variable

The dependent variable will be the performance of the hospital administration, assessed on the basis of:

- The speed with which operations are carried out;
- Admission and billing times;
- The ease of retrieving records;
- The reduction in errors and duplication;
- Staff productivity;
- The reliability and completeness of information;
- The speed of report generation;
- Coordination between departments;
- Traceability of income and expenditure;
- The quality of decision-making;
- Staff and user satisfaction.

#### 2.4.3. Mediating or moderating variables

Factors likely to influence the relationship include:

- The age and length of service of staff;
- Level of education;
- Its skills;
- Training received;
- Resistance to change;
- Management support;
- Availability of equipment;
- The quality of the network and the electricity supply;
- Maintenance;
- System security.

#### 2.5. Data collection techniques and tools

Data will be collected using:

1. A structured questionnaire for staff members, comprising closed-ended questions and Likert scales;
2. An observation checklist for equipment, processes and system usage;
3. A document analysis checklist to record processing times, errors, transaction volumes, revenue, reports and system interruptions;
4. A semi-structured interview guide for managers and key users.

The questionnaire will be pre-tested in another healthcare facility with comparable characteristics. The internal consistency of the scales may be verified using Cronbach's alpha, with a minimum value generally expected to be 0.70.

#### 2.6. Data analysis plan

Quantitative data will be analysed using SPSS, R, Stata or equivalent software. Descriptive analysis will include frequencies, percentages, means, medians and standard deviations.

An overall digitalisation score and an administrative performance score can be derived from the various dimensions. The relationship between them will be examined using:

- The chi-squared test for qualitative variables;
- Student's *t-test* or Anova for comparisons of means;
- Pearson's or spearman's correlation;
- Multiple linear regression for a continuous performance score;
- Logistic regression if performance is categorised.

The threshold for statistical significance will be set at  $p < 0.05$ , with 95% confidence intervals.

The interviews will be transcribed, coded and analysed thematically. The qualitative results will help to explain the mechanisms, difficulties and conditions for success observed in the quantitative component.

## 2.7. Ethical considerations

The study will be carried out after obtaining authorisation from the academic authorities, the relevant ethics committee and the management of the Hôpital du Cinquantenaire in Kisangani. Each participant will receive clear information on the objectives, confidentiality and voluntary nature of their participation.

The questionnaires will be anonymous and no patient names will be recorded. Data extracted from the system will be coded and stored on a secure medium. The results will be presented in aggregated form so that no participant can be identified.

## 3. Presentation of quantitative results

### 3.1. Characteristics of respondents

The sample comprises 120 staff members from the hospital's various administrative and medical-technical departments.

| Characteristics                          | Total or average | Percentage or standard deviation |
|------------------------------------------|------------------|----------------------------------|
| Men                                      | 69               | 57.5%                            |
| Women                                    | 51               | 42.5%                            |
| Average age                              | 39.8 years       | ET = 8.9                         |
| Average length of service                | 9.6 years        | ET = 4.8                         |
| Staff who have received digital training | 76               | 63.3%                            |
| Staff without digital training           | 44               | 36.7                             |

The proportion of staff who have received training suggests a workforce well-suited to using digital tools. However, more than a third of respondents have reportedly not yet received any training, which could limit the full use of the available features.

## 3.2. Level of digitalisation of administrative services

| Dimensions of digitalisation  | Average/5 | Standard deviation |
|-------------------------------|-----------|--------------------|
| Availability of digital tools | 3.82      | 0.62               |
| Actual usage                  | 3.86      | 0.58               |
| Module integration            | 3.26      | 0.60               |
| Data security                 | 3.35      | 0.66               |
| User training                 | 3.33      | 0.81               |
| Overall digitalisation score  | 3.52      | 0.54               |

The overall score – 3.52 out of 5 – indicates a relatively satisfactory level of digitalisation, though it remains incomplete. The effective use and availability of tools received the highest scores. Conversely, the integration of modules, security and training appear to be the least developed areas. This suggests a functional level of digitalisation, but one that is partially fragmented across departments.

### 3.3. Performance of hospital administration

| Dimensions of performance       | Average/5 | Standard deviation |
|---------------------------------|-----------|--------------------|
| Speed of operations             | 4.05      | 0.55               |
| Reliability of information      | 4.10      | 0.57               |
| Traceability of operations      | 3.93      | 0.63               |
| Inter-departmental coordination | 3.74      | 0.57               |
| User satisfaction               | 3.87      | 0.58               |
| Overall performance score       | 3.94      | 0.48               |

The reliability of information and the speed of operations are the areas rated most highly. Inter-departmental coordination has the lowest score, which may be explained by the fact that the applications used in the various departments are not yet sufficiently integrated.

### 3.4. The relationship between digitalisation and performance

The -e analysis reveals a strong positive correlation between the digitalisation score and the administrative performance score:

$$r = 0.829; p < 0.001$$

Simple linear regression yields the following results:

$$R^2 = 0.687; B = 0.732R^2 = 0.687;$$

$$\quad B = 0.732$$

In this hypothetical model, digitalisation accounts for 68.7 per cent of the variation in administrative performance. A one-point increase in the digitalisation score is associated with an average increase of 0.732 points in the performance score. However, this statistical relationship does not, on its own, prove a causal link.

### 3.5. Changes in administrative processing times

| Administrative process      | Before digitalisation | After digitalisation | Reduction |
|-----------------------------|-----------------------|----------------------|-----------|
| Patient admission           | 24.5 minutes          | 12.1 minutes         | 50.6%     |
| Searching for a file        | 17.8 minutes          | 5.3 minutes          | 70.2%     |
| Invoicing                   | 15.6 minutes          | 8.0 minutes          | 48.7%     |
| Preparing the dispatch note | 13.2 minutes          | 7.1 minutes          | 46.2%     |
| Average                     | 17.8 minutes          | 8.1 minutes          | 53.9%     |

The greatest reduction relates to searching for files. This illustrative result shows that digitisation could have its most visible impact on operations that previously required manual consultation of registers and archives.

### 3.6. Main constraints

The most frequently cited difficulties are network instability, reported by 40.8 per cent of respondents; electricity problems, reported by 37.5 per cent; and a lack of training, affecting 36.7 per cent of staff. Shortcomings in integration and security accounted for 7.5 per cent and 6.7 per cent of critical responses respectively.

These results show that the effectiveness of digital technology depends as much on the software as on its environment: electricity, connectivity, maintenance, training and the organisation of responsibilities.

### 4. Qualitative findings

The following quotes are examples of fictional verbatim transcripts. They illustrate how actual interviews might be presented.

**Theme 1:** Speed of administrative processing.

**Verbatim – E1, admissions officer:** ‘Before, we had to enter the same details into several registers. With the system, registration is quicker when the network is working.’

This account highlights a time saving, but also the conditional nature of this saving. Speed depends directly on the availability of the network and the equipment.

**Theme 2:** Traceability and control.

**Verbatim – E2, billing officer:** ‘Every transaction recorded leaves a trace. It becomes easier to check what has been billed and what has been paid.’

Digitisation would strengthen internal controls by making it possible to identify the author, the time and the nature of each transaction. This traceability can reduce errors, loss of information and disputes.

**Theme 3:** Accessibility of information.

**Verbatim – E3, archivist:** ‘Searching for an electronic file takes less time, but some older files are still only available on paper.’

The coexistence of paper and digital formats can result in a double workload. It highlights the need for a phased plan for digitising archives and a clear policy on document retention.

**Theme 4:** Business continuity.

**Verbatim – E6, cashier:** “During power cuts, we sometimes have to resort to handwritten notes and then re-enter the transactions.”

Technical disruptions reduce the expected benefits. Re-entering data increases the workload and exposes the hospital to duplicates, omissions and inconsistencies.

**Theme 5:** Training and Governance.

**Verbatim – E8, administrative staff member:** “Some colleagues only use the basic functions because they haven’t had any recent refresher training.”

**Verbatim – E10, senior manager:** “Technology alone is not enough; we need rules, clear responsibilities and regular monitoring of users.”

These accounts show that performance does not depend solely on the acquisition of software. It requires up-to-date skills, user support, written procedures and institutional leadership.

## 5. Discussion – Results

The overall level of digitalisation, rated at 3.52 out of 5, indicates that digital tools are available and in use, but have not been fully integrated. This finding is in line with the WHO’s global strategy, which states that digital transformation requires the coordination of technological, human, financial and organisational resources (World Health Organisation, 2021).

The positive relationship between digitalisation and performance is consistent with the review by Uslu and Stausberg, which shows that electronic records can improve the quality, efficiency and accessibility of hospital information. The authors point out, however, that the effects vary depending on the context and implementation methods (Uslu & Stausberg, 2021). Modi and Feldman also reach favourable conclusions regarding documentation, productivity, coordination and certain quality indicators (Modi & Feldman, 2022).

Weaknesses relating to training, connectivity and integration confirm the analysis by Fennelly and colleagues: the success of an electronic system depends simultaneously on technical, human, professional and organisational factors (Fennelly et al., 2020). Thus, installing software without ensuring ongoing training, maintenance and process re-engineering may simply shift existing difficulties.

In the African context, Victor and colleagues highlight the potential of digital technology for the management, planning and rational use of resources, whilst noting the limitations related to infrastructure and skills (Victor et al., 2023). A recent analysis of African strategies by Sylla and colleagues also highlights persistent shortcomings in terms of interoperability, funding, human resources and the legal framework (Sylla et al., 2025).

In the DRC, these findings would be in line with the guidelines of the National Plan for the Development of Health Information Technology, which regards digitalisation as a tool for streamlining, integrating and improving the health information system. However, they advocate for a transformation tailored to local constraints rather than a simple replication of external models.

Finally, Nguyen and colleagues point out that organisational benefits must not overshadow the costs of equipment, training, maintenance and technological renewal (Nguyen et al., 2022). The final assessment should therefore incorporate economic, technical, social and organisational indicators.

## 6. General conclusion

In the model, digitalisation is strongly and positively associated with the performance of hospital administration. It is thought to help speed up procedures, enhance the reliability of information, improve the traceability of operations and facilitate coordination between departments.

However, the expected benefits are neither automatic nor exclusively technological. They depend on the quality of the network, the availability of electricity, the integration of modules, data security, maintenance and user skills.

If the actual data confirm these trends, the Hôpital du Cinquantenaire would benefit from implementing an ongoing training programme, electrical backup and data backup systems, a cybersecurity policy, interoperability mechanisms and a regular performance monitoring dashboard.

These conclusions remain provisional. A full-scale survey, conducted amongst hospital staff and managers, is essential to gauge the true impact of digitalisation and to formulate valid institutional recommendations.

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## 8. Conflict of interest

The author declares that he has no financial, professional or personal conflicts of interest that might have influenced the design, conduct or presentation of this study.

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