ICT Governance in Higher Education: A Case Study of a Vocational College in Libya

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Abstract—This study focuses on ICT governance in higher education in a developing country. The research employs an interpretive single case study to describe and understand ICT governance at Alpha, a vocational computer college in Libya. Fourteen key informants, including deans, teachers, and students, participated in the interviews. Consistent with previous studies, our results reveal formal ICT governance arrangements at Alpha College. However, Alpha College leverages its general management structure and processes to make ICT decisions and fulfill the needs of the college stakeholders. In addition, the structure supporting ICT decision-making at Alpha College qualifies as “Centralized” while the ICT archetype of “Business Monarchy” best describes its ICT governance arrangements. Surprisingly, our study also reveals the hybridization of the role of the Dean through the integration of “entrepreneurial activities” amid his efforts to fulfill the ICT needs of the college in the context of severe budget constraints.

1. INTRODUCTION

The diffusion of information and communication technology (ICT) has profoundly revolutionized individuals' and organizations' lives in all industries including higher education. In particular, teaching and learning is increasingly being transformed by technology [1]. As a result, ICT is now considered a critical component for enhancing a wide variety of higher education core activities including teaching, research, communication, both domestic and international, administration processes, and record-keeping [2]. However, broadly speaking, despite substantial investments in ICT by higher education institutions, the full potential of ICT is never achieved [3].

In this context, understanding ICT governance in vocational colleges in Libya, a developing country, is important for at least four reasons: (1) ICT governance has emerged as an important issue in higher education institutions because it is seen as a relevant means for successfully and fully realizing ICT potential [4] (2) although there have been some studies of IT governance in the higher education sector, this kind of investigation in the context of developing countries, particularly in Africa, remains rare [5] (3) about 30% of the population of Libya is under the age of 15. Hence, education and training are pressing needs for the youth of Libya and previous studies have found that ICT-supported education systems are associated with increased economic development in the Third World [6] (4) Finally, several developing countries, including Libya, have identified education and vocational education in particular as a key domain to building the nation’s economy, since skilled graduates tend to play key roles in it [7], [8].

This research adopts a single case study design to analyze ICT governance in vocational colleges in Libya, employing an interpretive approach within the field of information systems [9], [10]. The study addresses the following research question:

- How is the governance of ICT orchestrated in vocational colleges in Libya?
- Has the governance model adopted by vocational colleges evolved over time and if so, how?
- How does ICT governance influence ICT effectiveness at vocational colleges?
- How does ICT governance influence vocational colleges’ performance?

2. CONCEPTUAL BACKGROUND

2.1. ICT Governance

Based on [11], [12] defines corporate governance as “the range of control mechanisms that protect and enhance the interests of shareholders of business enterprises.” Consequently, IT governance is a subset of corporate governance. [13] highlight the link between ICT governance and corporate governance through the definition of ICT governance as “the exercise of decision rights, as a subset of corporate governance, and the design and execution of structures and processes to manage risk and implement organizational objectives.” For their part, [14] define IT governance as “specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT.” [14] identifies five major decision IT decisions: IT principles, IT architecture, IT infrastructure strategies, business application needs, IT investment, and prioritization. Based on the distribution

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of decision rights or input rights regarding these five major IT decisions, the author defines six archetypes of ICT governance: business monarchy, IT monarchy, feudal, federal, IT duopoly, and anarchy.

2.2. ICT in Higher Education

Effectively integrating information and communication technology (ICT) into education is a complex endeavor influenced by factors beyond technology alone. The following factors have been found to influence ICT adoption and management in higher education:

- Funding challenges, teacher competencies, and student involvement: all these factors have an impact on the adoption and use of ICT in higher education [15].
- Management involvement [16].
- Effective ICT policies at the institutional level which are necessary for education management [17].

2.3. ICT Governance in Higher Education

ICT governance has become a critical activity in higher education institutions due to its strategic importance [18]. Effectively implementing ICT and ICT governance requires the establishment of strategies, processes, policies, structures, and responsibilities specific to the utilization of ICT within these institutions [19], [20]. It is essential to identify individuals responsible for strategic planning, decision-making, resource allocation, and utilization [21]. The need for robust ICT governance in higher education institutions is further emphasized by the rapid advancements in ICT and the desire to maximize ICT investments, which necessitates access to information and control over ICT activities [22].

The adoption and governance of ICT in higher education aim to enhance the capabilities of the institution, define strategies, and deliver quality education services while ensuring financial accountability [23]. Higher education institutions increasingly rely on ICT for control and monitoring of their operations [24].

Several scholars have underscored that the lack of progress in ICT governance in higher education can be attributed to the adoption of inappropriate governance models that fail to align with organizational strategic objectives and structures [24]. The implementation of ICT governance involves both adoption and implementation phases, with the latter being more complex due to the intricate interactions between technology and various stakeholders within higher education institutions [25]. Other scholars have stressed that challenges related to accountability, funding, administration, leadership, equipment, and infrastructure could act as obstacles to the implementation of ICT governance, particularly in vocational college environments [26].

2.4. ICT Governance in Higher Education Dimensions

[27] propose three dimensions that effectively describe ICT governance: Structures, Processes, and Relational Mechanisms. Each of these dimensions is explored in further detail below.

- **Structure**
  ICT Governance structure is defined as the decision-making structure and accountability for IT-related decisions [28]. Governance structure may encompass committees comprising technical and functional managers and directors including the definition of roles and responsibilities [29]. ICT Governance structure can be centralized, decentralized, or federal [30].

- **Processes**
  ICT governance processes describe the mechanisms that allow the integration of business and ICT decision as well as their implementation and monitoring [31]. Processes encompass the organization's planning and decision-making regarding IT-related matters, employing selected frameworks and tools to enhance performance [32]. Effective governance processes include ICT performance measurements and frameworks such as COBIT, ITIL, People Capability Maturity Model (P-CMM), OCTAVE, NIS, and ISO/38500. Conversely, ineffective ICT governance processes are often associated with inefficient management, leading to the waste of resources [33].

- **Relational Mechanisms**
  Relational mechanisms within IT governance are often seen as adaptable and interactive components [27]. These relational mechanisms encompass various elements, such as collaboration between principal stakeholders, corporate internal communication, and informal meetings between business and IT executive/senior management [27], [29], [34].

3. RESEARCH METHOD

This research is a field study within the interpretive tradition of information communication technology [9], [35] aiming to investigate ICT governance in higher education colleges in Libya. The study focused on examining ICT governance arrangements at a vocational college in Libya and identifying influencing internal and external factors through the perspectives of key actors. Following the principles of interpretive research [9], the study sought to gain insights into ICT governance and influencing factors, by examining the meanings ascribed to them by vocational college stakeholders in Libya including the management team, teachers, staff, and students.

We used the concept of ICT governance and associated dimensions as an initial lens to guide data collection and analysis. In addition, we adopted an emergent process, allowing us to challenge the initial lens while acknowledging new theoretical concepts to develop organically at various stages of the research, drawing inspiration from previous works [36], [37].

The research focused on Alpha, a vocational computer college in Tripoli, Libya. Thus, we conducted an interpretive single case study.

Alpha is one of 18 technical colleges under the aegis of the Libyan Ministry of Technical & Vocational
Education. It was formally established as an urban Higher Technical Institution offering 3-year programs in the early 90s and then upgraded to a 4-year Technical College about twenty years later. The college is in the suburb about 12 kilometers from downtown Tripoli. Today Alpha College has 3 technical computer programs (Computer Network, Automation, Control Systems, and Software Engineering), and 1030 students from Libya and other Middle Eastern countries of whom 100 graduates each year on average join the 1868 alumni throughout the world. The Alpha College employs more than 200 people including 55 teachers.

The Department of Information Technology works with external partners to serve more than 1000 technology users every year. Of note is that since 2021, Alpha College has spent 10% of its annual budget on information technology whereas the average budget was 7.5% over the previous three years. The IT department has 8 staff members, and the IT infrastructure is composed of 30 servers running on five operating systems and 250 desktop computers including 220 dedicated to students. Most computers are distributed in 10 laboratories with 20 stations each.

The level of sophistication of the software application portfolio is relatively low as it is composed of Microsoft Office package, Google Drive, C Sharp with .NET, Java, Visual Basic, C++, SQL database, Lab View, a system-design platform and development environment for a visual programming language, Arduino (Open-source electronic prototyping platform enabling users to create interactive electronic objects), Mat Lab, and HFSS (Multipurpose, full wave 3D electromagnetic (EM) simulation software for the design and simulation of high-frequency electronic products such as antennas, components, interconnects, connectors, ICs and PCBs).

The college has a dedicated website open to the public that is also used for the online evaluation of courses by students.

The study relies on three sources of data collection to enhance the level of internal validity of the results. First, semi-structured interviews were conducted with 14 key informants including the dean of the college, and four managers of offices (academic affairs, teachers’ office, registration, administration). In addition, the head of each one of the three programs was interviewed: Computer Network, Automation and Control System, and Software Engineering. Furthermore, the Chief Information Officer (CIO) as well as two teachers and three students were interviewed. Each interview lasted about 75 minutes.

All interviews were conducted in Arabic and recorded totaling nearly 15 hours and transcribed verbatim first in Arabic then from Arabic to English into 223 pages. Second, documents, along with publicly available press releases related to the college were consulted. Lastly, the first author was given a guided tour of the college facilities, and he was able to take notes during the interviews and the tour. In total, the research involved the analysis of 416 pages from the interview transcriptions and collected documents.

The process of data analysis commenced during data collection, following an iterative process guided by the “hermeneutical cycle” a central principle in interpretive research [9]. The researcher continually moved back and forth between the entire dataset and its components to deepen their understanding of ICT governance at Alpha College. The collected data was then repeatedly reviewed and interpreted by the two authors, consistently challenging initial interpretations [9], [38]. Hence, a comprehensive understanding of the social and historical background of ICT governance at Alpha College was developed through multiple iterations.

The researchers first employed a narrative strategy [39] which meant constructing a meta-story in a “narrative report” to describe the evolution of ICT governance and internal and external influencing factors at Alpha College. This process facilitated the development of a holistic understanding based on the interpretation of the meanings given to events by respondents in their accounts. Finally, by applying interpretive principles of abstraction and generalization, the researchers derived theoretical concepts from their findings, drawing on ICT governance dimensions, concepts, and evolution [40]. This iterative process involved moving between the data and selected concepts within the “hermeneutic circle” [9].

Of note is that [41] distinguishes between ‘statistical’ and ‘analytic’ generalization. He underscored that it is throughout an analytical generalization that it is possible to find similarities and differences among the phenomena of interest in the case studies. Analytical generalization is possible with a single case study [41], [42] and it can take the form of concepts, theories, specific implications or rich insights’ [10].

4. Results

The findings from the interviews provide rich insights into ICT governance at Alpha, a vocational college in Libya. Alpha College does not have a formal ICT governance arrangement. The college has been functioning with the same structures and processes over the past five years.

Our findings can be further presented and discussed in the context of the theoretical framework, specifically the dimensions of ICT governance in higher education institutions: structures, processes, and relational mechanisms as well as ICT governance concerning the college performance.

Structure

The organizational structure of Alpha College in Tripoli is composed of five levels, the two first being the dean’s office (1) and the vice dean’s office (2). The third level is composed of seven organizational units or offices: quality control, human resources, internal audit, legal affairs, administration and finance, registrar, and scientific affairs. The internal audit office is led by a government officer who controls the finances of the college and reports directly to the Ministry of Finance.

There are six organizational units or offices under the leadership of the Scientific Affairs Office: Faculty department, curriculum planning, Chief Information Office, Scientific department, internship, and Library. The scientific department is composed of three departments corresponding to the three specialization programs offered by the college: Computer Network,
Automation and Control System, and Software Engineering. Hence, the higher position related to ICT is the Chief Information Officer at the fourth level of the chart, led by the Chief Information Officer (CIO) who reports to the Scientific Affairs Officer. The CIO is assisted by 3 IT staff members responsible for system development and maintenance.

There are no specific committees related to ICT governance at Alpha College. However, in terms of the "corporate governance" of the college, there are five committees: the board of the college, the scientific affairs committee, the technical committee, the personnel affairs committee, and the purchasing committee. The CIO is a member of one committee, the technical committee which he also led. The other members of the technical committee are the heads of each one of the three specialization programs offered by the college.

Our analysis reveals that the decision-making process related to ICT is centralized within the board of the college that meets once every three months, as is the case for other administrative and academic matters. However, the CIO is not a member of the board of the college, but the head of the Scientific Affairs office is. The fact that the CIO does not sit on the board of the college has several implications for ICT governance outcomes. For instance, the quality of some equipment or services purchased directly by the Council Board of the college did not comply with the required level of quality defined by the CIO.

Processes
The main IT Governance process at Alpha College is related to prioritizing ICT spending within the limited budget provided to the College by the Ministry of Technical Education every semester. The allocation of ICT spending covers updating software, acquiring computers for the laboratories, and developing the ICT infrastructure. The process of budgeting has three steps. The first step is the definition of a budget proposal by the Technical Committee. The proposed ICT budget is then transferred to the head of the Scientific Affairs Office who presents it for incorporation into the college’s annual budget at the Council Board of the College. The college's annual budget is divided into 3 parts: (1) staff salaries (2), maintenance and operation, and (3) overhead expenses (material for colleges). The ICT budget is included in the second part and accounts for about 10-15% of the overall budget as stated earlier.

The annual budget approved by the Council Board of the College is then sent to the Ministry of Technical Education. Of note is the fact that the Ministry of Technical Education sent the budget to the Ministry of Finance who made the final decision on the amount to be provided to the College. It is important to note that over the past five years, there has always been a gap of 40-45% between the requested budget and the amount provided to the College by the Ministry.

Our interviews revealed that the Ministry of Technical Education always tries to secure the requested budget for vocational colleges, but the government allocates more funds to the Ministry of Higher Education at the expense of the Ministry of Technical Education.

Relational mechanisms
Our results reveal several relational mechanisms deployed by the leadership team with all stakeholders to manage the College ICT resources and needs. There is a good level of collaboration between the College management and several external ICT stakeholders. For example, due to budget constraints, the college cannot always afford to invest in the acquisition or maintenance of ICT equipment or services. However, the Dean was able to secure some equipment or services from external providers at a preferential price, including some support.

The internal communication with the college community is heterogeneous. For instance, it is not easy for the college to reach out to the college administrative staff and students because not all of them are using the college email addresses. However, the college can easily send messages to teachers because all of them are using the college email addresses.

In addition, there are formal and informal meetings between the ICT team and the College administrative staff, teachers, and students related to ICT users’ needs.

ICT Governance and College Performance
Our analysis reveals the College does not have formal indicators to assess the effectiveness of ICT governance or the performance of the institution. However, there is a unanimous agreement among all informants regarding the importance of effectively utilizing ICT across all facets of the college activities. More specifically, the College emphasizes the use of ICT for enhancing teaching and learning followed by ensuring cost-effective use of ICT, then streamlining administrative processes through effective ICT utilization. The management’s willingness to leverage ICT to improve the processes is illustrated by the plan to offer online the two following services in the coming two years: student registration and the publication of the student’s results.

Furthermore, in evaluating performance, Alpha College's Council board identified the relative significance of these outcomes on the performance of the college. The following criteria are used to measure the perceived performance of the College: (1) the number of student applications that the College receives every year. During the last three years, the College has been organizing an entrance exam because the number of student applications has been about 1000 for an acceptance capacity of only 350 students (2) All students who graduate from the college find a job within two months following their graduation because of the quality of the college curriculum and more specifically the integration of ICT.

5.Discussion and Conclusion
Even though there is a consensus on the critical role of ICT and ICT governance in higher education, few studies have investigated ICT governance in the context of a developing country. It is important to remember that vocational colleges ought to play a critical role in the economic development of Libya as 26% of the population of the country is between the ages of 0 and 4. [43]. Our study investigates a vocational college in Libya, a
developing country to address the following research questions:

- How is the governance of ICT orchestrated in vocational colleges in Libya?
- Has the governance model adopted by vocational colleges evolved over time and if so, how?
- How does ICT governance influence ICT effectiveness at vocational colleges?
- How does ICT governance influence vocational colleges' performance?

Consistent with [20] who find that some countries have adopted regulatory frameworks and laws related to ICT governance in higher education while others have not, our findings for Alpha College are thus not surprising because Libya has not adopted frameworks such as COBIT, ITIL, ISO/IEC series [20] and laws related to ICT governance for higher education.

Despite the lack of formal ICT governance, Alpha College is leveraging its general management structures and processes to manage the rights and decisions related to ICT to fulfill the needs of the college community. So, going back to the literature on ICT governance, the functioning of Alpha College has always been based on a "centralized structure" and like the governance archetype labeled "business monarchy" [14] because all the decisions related to ICT architecture, ICT infrastructure, business applications need, and ICT investment are made by the council board of the college that is composed of "business managers". However, the inputs came from the Technical Committee led by the college CIO. It is worth recalling that, there is no consensus on the most adequate ICT governance structure or archetype for higher education institutions. For instance, [44] recommended the federal structure for higher education institutions so that all stakeholders inside and outside can have a role in the pyramid of power and decision-making authority. In contrast, [45] recommended a centralized structure if the institution has only one campus such as in the case of Alpha College.

Our analysis revealed a hybridization of the role of the Dean. Based on [46] the dean's role in higher education institutions can be summarized as follows: Organizational Leadership, Personal Scholarship, External Relations, Department Administration, and Student Support. Surprisingly, in the case of Alpha College, the dean's role includes "entrepreneurial activities", and more specifically "environmental scanning". In fact, within entrepreneurial competencies, "environmental scanning is defined as the acquisition and use of information about events and trends in an organization's external environment, the knowledge of which would assist management in planning the organization's future courses of action" [47].

Our results reveal that the dean creates and develops new partnerships with various stakeholders to support the college in fulfilling the community's needs in terms of ICT services and equipment and compensating for budget constraints. This finding confirms the influence of the institutional context of the organization on ICT governance [30]. The last authors underscored the influence of the environmental context of the organization on ICT governance.

The present study provides some implications for research and practice. Our study contributes to a deeper understanding of ICT governance in higher education in the context of a developing country through "thick description" [48] that may be of interest to practitioners and other researchers who can derive informed conclusions based on the transfer of knowledge gained in this case study. From a practical standpoint, our results indicate that governments in resource-constrained settings such as developing countries should give preference to profiles with entrepreneurial skills when making appointments for deans and encourage deans to develop entrepreneurial skills.

In conclusion, while more empirical studies are needed to surmount the limitations of this single case study, we offer rich insights to ICT governance stakeholders in higher education institutions.

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