Context of ICT Integration in Public Higher Education Institutions in Antsiranana (Madagascar)

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Abstract

This paper investigates the integration of Information and Communication Technology (ICT) in higher education institutions in Antsiranana, Madagascar. It examines the challenges, policies, and leadership strategies affecting this integration, highlighting Antsiranana's specific context within the broader Malagasy educational landscape. The paper develops a conceptual framework identifying key factors for successful ICT integration, combining insights from Antsiranana and wider Madagascar. This framework provides a comprehensive guide for effective ICT adoption in higher education institutions.

Keywords: ICT Integration; Higher Education Institutions; Antsiranana Public Institutions; Educational Policy; Educational Leadership; Madagascar

1. Introduction and background

This study explores the effective use of ICT in education in Madagascar, with a particular emphasis on public higher education institutions in Antsiranana. It delves into the unique challenges and opportunities Madagascar faces as a developing country, examining government policies, local initiatives, and leadership strategies for ICT integration. The paper highlights the specific case of Antsiranana, analyzing its policies and challenges in integrating ICT into higher education. This analysis is crucial for understanding how ICT is adapted and adopted in Madagascar's educational landscape, forming the foundation for a detailed case study in Antsiranana. Notably, in the context of ICT integration into higher education institutions, a one-size-fits-all policy has not yet been established, indicating the absence of a national policy for ICT implementation. This exploration culminates in a conceptual framework detailing key factors for successful ICT integration.

1.1. Integrating ICT into higher education in Madagascar

In today's global digital age, Madagascar, like many other developing countries, recognizes the value of Information and Communication Technologies (ICT) in its various sectors, including higher education. This sector in particular has been profoundly influenced by the digital revolution, as it plays a crucial role in the transmission of constantly evolving knowledge. The integration of ICT into higher education in Madagascar presents a complex landscape of initiatives and challenges. In our present study, we found that studies on the

integration of ICT in education in Madagascar are still limited, despite the complexity of this field and the particular interest that needs to be aroused. In 2007, the World Bank conducted a survey on "ICT AND EDUCATION IN AFRICA" covering 53 countries. Madagascar was included in this survey, with the report written by Shafika Isaacs. The report provides an overview of the state of ICT in education in Madagascar, highlighting a number of important points. Madagascar has taken steps to encourage the use of ICT for development by adopting two key policies, the National ICT Policy in 2004, and the Madagascar Action Plan for 2007-2012 for economic and social development, thus promoting the expansion of ICT infrastructure and access in the country, notably by establishing ICT centers in schools. As far as higher education itself is concerned, the Malagasy government, through the Ministry of Higher Education and Scientific Research, has included in its strategic plan a commitment to adopting a higher education structure aligned with the international standards of the LMD (Licence-Master-Doctorat) model, while taking into account existing local specificities. This transition to the LMD system in Madagascar was formally established by article 12, paragraph 1, of Decree n°2012-831, which amends certain provisions of Decree 2008-179 of February 15, 2008. According to this decree, migration to the LMD system has been planned on a gradual basis, beginning as early as the 2007-2008 academic year and due to conclude no later than the start of the 2013-2014 academic year (Ministère de l'Enseignement Supérieur et de la Recherche Scientifique, 2013). This implementation of the LMD system in Malagasy higher education was initiated following the publication of official texts in 2010 (see www.mesupres.gov.mg). This major change in the education system was encouraged by international bodies such as UNESCO, the European Union, the World Bank and the Agence Universitaire de la Francophonie (AUF) (Ikando, 2009). The transition of the Malagasy education system to the LMD system implies the need for accompanying measures, both in terms of infrastructure and organization, and the integration of ICT into higher education is one of these essential measures. Thus, a section dedicated to ICT implementation has been formulated in the Ministry of Higher Education's outlook dossier to ensure its development along this reform path, as cited below:

- Creation of human resources management software, which is now effective thanks to the digitization program resulting from collaboration between the Ministry of Higher Education and Scientific Research and the Ministry of Digital Development, Digital Transformation, Post and Telecommunications;
- Implementation of the national research policy linked to ICT and scientific and technical information management to complement existing platforms. 3V policy: Visibility of national research centers, Valorization of research work, Popularization of ICTs among researchers (marketing, website, magazine, etc.)
- ICTs and Administration: support for the popularization of ICTs within the administration, with the gradual renewal of computer equipment (Ministère de l'Enseignement Supérieur et de la Recherche Scientifique, 2013).

These ICT initiatives also include training programs for teachers to enhance their ICT skills, the establishment of technological infrastructures in higher education institutions and partnerships with international organizations to access ICT resources and knowledge. These efforts are aimed at improving the quality of higher education in Madagascar, strengthening research and promoting access to education. In addition, this reform aims to harmonize Madagascar's education systems with international standards, thereby promoting student mobility and international recognition of diplomas. In addition, in order to foster research geared towards sustainability, this educational policy reform should enable higher education to develop further, by gearing training programs towards better integration of students into the job market. Two major expectations therefore emerge from the adoption of this LMD system, namely the strengthening of research with a view to its professionalization and the implementation of higher education focused on sustainable development (Ministère de l'Enseignement Supérieur et de la Recherche Scientifique, 2013). So, even in the face of challenges and initiatives influencing its course in the use of ICT for higher education, Madagascar

has taken significant steps to promote the latter. In other words, there are progressive initiatives in the country that attempt to promote access to and use of ICT to support learning and teaching, even if these sometimes take the form largely of extracurricular projects.

It is important to note, however, that there are considerable efforts on the part of the main education and teaching authorities in Madagascar, notably the Ministries of National Education and the Ministry of Higher Education, to integrate ICT into education. This significant involvement reflects the importance attached to the integration of ICT in Madagascar's educational context. As an example, Madagascar, represented by staff from these two aforementioned ministries, took part in the 2015 World Education Forum, held in Incheon, Republic of Korea, part of whose agenda addressed improving the quality of education for all, as well as transforming learning and teaching through technology. Organized by UNESCO in conjunction with UNICEF, UN-Women, UNFPA, UNHCR and the World Bank, and hosted by the Korean government, the World Education Forum (WEF) 2015 brought together some 1,600 participants, including 120 ministers of education from 160 countries and representatives of UN agencies, international donors and non-governmental organizations. The discussion around the transformation of learning and teaching through technology in higher education resulted in recommendations for the representatives of each country present. The potentially positive impact of digital technologies on learning and teaching was highlighted. The report stresses that technologies can empower teachers and learners throughout their lives, preparing them for their role in a globalized world. To fully realize this promise, it is essential to provide adequate support and focus on uses of technology that actually improve learning and teaching, rather than simply installing equipment. It is also recommended to develop a global model based on a vision of student success, encompassing all the elements necessary for a significant transformation of education (UNESCO: World Education Forum, 2015). As a result of this global forum, implementation challenges are emerging that government leaders must address: the challenge of strengthening education financing, the challenge of effective governance and accountability for shared responsibility, and the challenge of monitoring and coordinating the future global education agenda (UNESCO: WEF, 2015). In addition, Madagascar was among the twenty-two African countries that took part in the African Ministerial Forum on ICT Integration in Education, held in Abidjan, Côte d'Ivoire, from June 7 to 9, 2017. The aim of the forum was to accelerate the integration of ICT in education in Africa, with a view to promoting the knowledge society and achieving the objectives of the African Union's Agenda 2063 and the Sustainable Development Goals (SDGs). Also as part of the integration of ICT into higher education, in October 2023, the Ministry of Higher Education and Scientific Research signed a three-year agreement with SPARKSO to introduce digital technologies into teaching. The aim of this partnership is to gradually transform teaching through the use of digital technologies. SPARKSO, which specializes in Blockchain, aims to secure student information and university documents such as diplomas and transcripts, using a secure, unforgeable system based on Blockchain technology. Students and staff will thus have secure access via QR code and password, and teaching will also be digitized with online courses. SPARKSO's Blockchain technology guarantees data security and transparency. The partnership provides for projects tailored to the specific needs of universities, higher institutes of technology and research centers reporting to the Ministry (Ministère de l'Enseignement Supérieur et de la Recherche Scientifique, 2023).

However, there are still a number of challenges to be overcome in order to promote digital development in Madagascar's higher education sector. One of the main obstacles is the lack of financial and technological resources. Higher education in Madagascar faces severe budget constraints, limiting its ability to invest massively in ICT. In addition, Internet accessibility and connectivity remain a challenge in many parts of the country, hindering access to online resources and communication. Another important challenge is the ongoing training of teachers to familiarize them with ICT and its pedagogical use. Resistance to change and negative perceptions of ICT can also hinder the widespread adoption of these technologies in higher education establishments.

Ultimately, Madagascar faces a delicate balance between the opportunities offered by ICTs and the limitations inherent in its status as a developing country. This complex dynamic requires ongoing strategic reflection and targeted investment if ICT integration is to make a significant contribution to improving higher education in Madagascar.

1.2. Contextual analysis of public higher education institutions in Antsiranana in the integration of ICT in education

The contextual analysis in this section is of paramount importance to this study, as it is the pillar on which a deep understanding of the specific challenges, opportunities and needs these establishments face in terms of ICT integration is built. It is also in this section that we will discuss the conceptual framework that defines this research. The present study was carried out in the nine public higher education institutions located in Antsiranana, Madagascar. They are Faculté des Lettres et Science Humaines (FLSH), Faculté de Sciences (Fac Sciences), Faculté de Médecine (FacMed), Faculté de Droit Economie Gestion et Sciences Politiques (DEGSP), Institut Supérieur en Administration des Entreprises (ISAE), Institut Supérieur en Technologie d'Antsiranana (IST-D), Ecoles Supérieur Polytechniques d'Antsiranana (ESPA), Ecole des Sciences Agronomiques et Environnementales de Diego (ESAED), Ecole Normales Supérieur de l'Enseignement Techniques (ENSET). Like many public higher education institutions in Madagascar, these establishments have also embarked on the reform of higher education and scientific research, which is none other than the LMD system. Although it has been demonstrated that the transition to this system offers many advantages, such as learner mobility, optimizing programs according to labor market needs, and improving the international competitiveness of Malagasy higher and technical education, many challenges remain for its full implementation in the education system of our local public institutions in Antsiranana. One of the major challenges we have identified relates to the policy of reform, which implies the need to develop new infrastructures and introduce pedagogical and administrative reorganization within these institutions, and also to the introduction of ICT in pedagogy. The public higher education establishments in Antsiranana are still constantly struggling to keep pace with technological developments, as it is clear that the road they have embarked on is not as smooth as it should be, and that challenges still persist in every nook and cranny. To achieve the objectives of the education system reform and guarantee its successful implementation, it is essential to provide support right from the initial phase of transition to the LMD system, until the establishments concerned are well on the way to using it.

As the digitization of education is considered inescapable in the current context, no higher education institution can escape the use of ICT in its educational environment. ICT has a major impact on the field of education, which explains the efforts of heads of higher education establishments to implement ICT in their institutions. The integration of ICT into higher education institutions in Antsiranana is an initiative that has gained momentum in recent years, although each institution is at a different stage of the process. Even if the degree of their involvement in this direction differs, their initiatives in appropriating technological tools or infrastructures, their commitments to collaborate with certain partners to foster the professional development of ICT stakeholders, their willingness to reorganize the performance and processing of administrative and pedagogical tasks, and their support in achieving the objectives set for ICT use all testify to their determination to move in this direction. The underlying objective for all is clear: to improve the quality and efficiency of teaching/learning and administration through the use of ICT. As an illustration, we found that there is a certain willingness on the part of some establishments to aspire to becoming a fully-fledged digital establishment, reflecting a global trend. Others, meanwhile, are seeking to make teaching more interactive and collaborative. In terms of infrastructure, most establishments have at least the basics such as computers, video projectors and Internet access. However, the depth of this infrastructure varies greatly. Some have more or

less well-equipped computer rooms, and are planning ambitious digitalization projects for 2023-2024. Others, on the other hand, have a more modest infrastructure, with just a few computers and projectors. What is more, these establishments have attempted to put in place various strategies and policies to facilitate the integration of ICT. These strategies include professional development, capacity building and encouraging the use of online platforms. Some have adopted a softer approach, giving teachers the freedom to choose their level of engagement with ICT. However, like many schools in other towns in Madagascar, those in Antsiranana still suffer from a lack of successful implementation of ICT in their education system. In our present context, we have identified factors that hinder the effective integration of ICT into their schools. These elements can be translated into opportunities or factors that guarantee the successful use of ICT in these establishments. The way in which these key determinants of ICT success can be addressed is a matter for the leaders themselves, and derives from their policy and strategy for implementing ICT in their institution. The leadership model of the institution's managers, the availability of infrastructure and resources, professional development, pedagogical change, resistance to change, the policy of ICT implementation and the progressive evaluation of the ICT integration initiative are factors that either hinder or guarantee the successful integration of ICT in education in these institutions.

The leadership model of ICT leaders can significantly influence the integration and adoption of ICT in higher education institutions (HABIBALLAH et al., 2021). It also defines the policy of ICT use by leaders within the institution's overall educational strategy. As a result, the appropriate leadership model applied within the institution significantly affects the overall process of all administrative and academic activities. As Tony Bush (2003) has pointed out, the quality of leadership has a considerable impact on teaching and learning outcomes. Furthermore, it is the role of school leaders to pave the way for the integration of technology into all stages of education within their institutions by adapting it as an integral part of their working strategy and advocating its use by becoming role models in the field of technology (Banoğlu, 2011). Yu & Darrington's (2006) studies support the integration of technology into institutions and believe that this process starts with the minds of institutional leaders first. It is true that many players need to be considered in order to achieve the objectives relating to the use of ICT in education; however, the main responsibility for its implementation lies with school leaders. Moreover, they are considered to be the most important factors influencing the use of technology in schools. Arooj Ahmed Qureshi (2013) supported this view, emphasizing that the key factor in the effective use of ICT in teaching and in the learning process lies with school leaders. He raised the responsibilities of the latter to encourage and share their vision of ICT with their staff at all levels, because again according to him when the leader is enthusiastic and visionary about the use of ICT, the realization of administrative and pedagogical tasks becomes fluid within the said institution. In the case of public higher education institutions in Antsiranana, leaders are endowed with the skills that make them capable of leading the institutions and aligning their vision with the various objectives set. Not only are they responsible for financial operations, infrastructure and personnel management, public relations and curriculum coordination, but in recent years, with technological advances in pedagogy, they have been entrusted with even more complex responsibilities as technology leaders, whose main role is to ensure the effective implementation of information and communication technology in the institution. Given all these responsibilities, the leader represents a significant figure in ICT integration. In other words, the role assumed and practices exercised by the leader are the most powerful factors in the integration of ICT within the institution. Supported by Hayes (2006), he reported that leaders are central figures in ICT integration, facilitating or hindering its implementation phase. After analyzing the situation within these institutions, we found that the challenge lies in the process of implementing ICT initiatives, and that this stems from the leadership model applied by the leaders. The leader's effective leadership practices are imperative variables for successful ICT implementation, according to Tearle (2003). This means that a major factor in the ineffective implementation of ICT in the learning environment is the lack of a clear rationale for leadership

practices in the incorporation of ICT into the institution. For example, despite the adoption of ICT in their pedagogical practices, educators have limited knowledge of how to effectively integrate ICT into classroom practices (Al harbi, 2014); they lack capacity building in the use of ICT. In many cases, ICT adoption is often carried out without a solid understanding of what the technologies should improve, and in the absence of clear guiding values. This view is supported by Twining (2007), who argues that the lack of a shared vision of the value of technological tools in education explains why, despite substantial investment in educational technology, the desired results are not yet being achieved. Thus, simply providing institutions with useful technological tools, infrastructure and ICT resources does not guarantee successful ICT implementation if the leader does not adopt an appropriate educational policy and a clear strategy for ICT adoption. In a way, this situation may be understandable, as without a clear ICT implementation policy to support school leaders, it would be difficult for them to ensure the successful integration of ICT. In fact, Madagascar does not yet have a national policy on ICT in higher education. Although the government, represented by the Ministry of Higher Education, is currently working on this by taking initiatives for digital development in higher education, many challenges remain for the institutions concerned. As a result, institutional leaders are often working on their own to integrate ICT, in the absence of clear guidelines and support at local and national level.

In their role as leaders in managing and resourcing ICT stakeholders, Flanagan and Jacobsen (2009) explain that school leaders are responsible for managing the resources required for technology integration. This includes setting budget priorities that directly support the objectives of the school's technology plan. Another factor hindering the successful integration of ICT into public higher education institutions in Antsiranana is the lack of technological resources or infrastructure. Many initiatives have been taken to acquire ICT materials and infrastructure, but this is far from sufficient. While some establishments have invested considerably in this area, with the aim of overcoming their lack of technological infrastructure, others are still lagging far behind, possessing only a few basic ICT tools. Consequently, it is difficult to effectively integrate ICT into teaching and learning activities if the higher education institution in question does not yet have an adequate technological infrastructure, including a reliable Internet connection, appropriate hardware and software. In other words, the absence or inadequacy of these technical elements partly explains the inefficiency of successful ICT implementation in the university context. Thus, teachers and students in these institutions still face difficulties in accessing online resources, unable to use specific learning software or participate in distance learning activities due to these technological limitations. In addition, the lack of adequate professional development opportunities for teachers and ICT leaders also contributes to the failure to use ICT effectively in teaching and learning (Supriadi & Sa'ud, 2017). Training programs and ongoing support are essential to strengthen the ICT skills of educators and leaders. However, efforts in this area are still very limited or non-existent in some schools located in Antsiranana. In addition, the problem of resistance to change in the face of innovation or use of ICT in the institution, as well as pedagogical change and the lack of progressive evaluation in terms of initiative in the use of ICT still remain a major challenge and a common problem in most of these establishments. To address these issues, a holistic approach is required, including leadership development, professional development programs, infrastructure improvement, policy development and consideration of progressive ICT assessment. By addressing these challenges, the heads of the respective higher education institutions can create an environment conducive to the effective integration and use of ICT in the institutions.

2. Key Factors in the Integration of ICT in Higher Education

Following an exhaustive review of the literature on ICT integration in higher education institutions, several key factors emerged as major determinants of success. These factors include the leadership model, infrastructure and resources, professional development, pedagogical change, resistance to change, policy and

implementation strategy, and progressive evaluation of ICT use. Each of these elements plays a crucial role in how ICT is adopted, integrated and evaluated within educational institutions.

The effectiveness of ICT integration in public higher education institutions in Antsiranana is significantly influenced by a leadership model that actively supports digital transformation policies, allocates sufficient resources for professional development and infrastructure, and adopts a participatory approach to overcoming resistance to change. Such leadership approach is likely to foster greater ICT adoption, improve pedagogical and administrative processes, and have a positive impact on the overall educational experience. It also suggests that the challenges associated with ICT integration, such as lack of infrastructure, resistance to change, and the need for professional development, can be better addressed through enlightened leadership strategies and sound institutional policies.
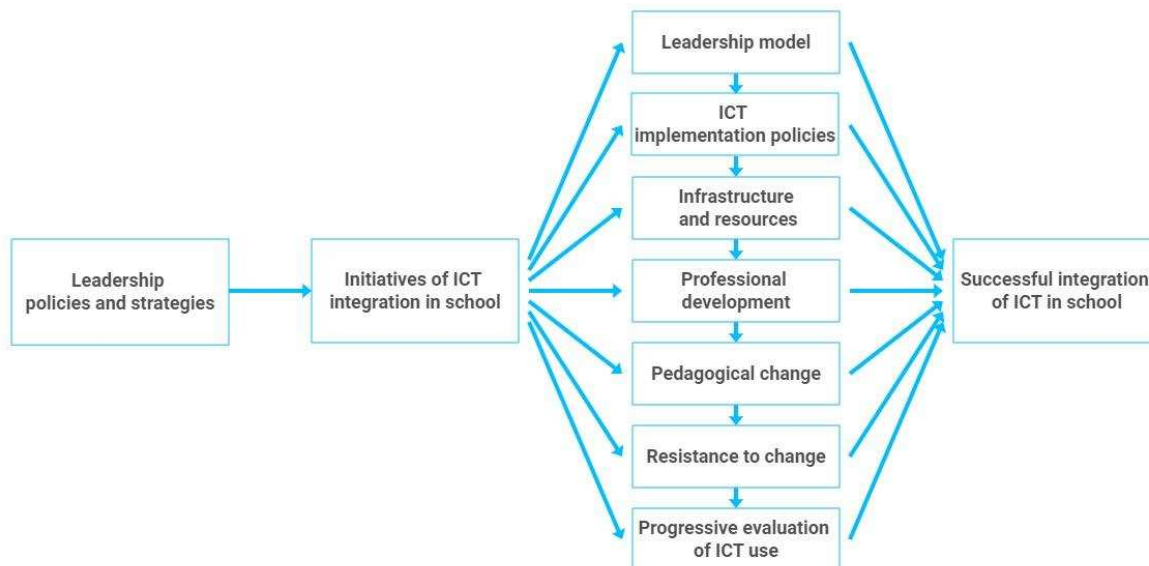

Fig. 1. Conceptual framework

The conceptual framework described above illustrates the process and steps by which a leader's policies and leadership strategies influence the successful integration of ICT into an educational institution.

2.1. Leadership policies and strategies

This is the starting point of the framework. Here, we recognize that the leader plays a crucial role in defining the policies and strategies that will guide ICT integration. The leader's decisions, vision and strategic direction are essential to initiate steps towards ICT integration.

2.2. ICT integration initiatives

Following the establishment of policies and strategies, concrete initiatives are launched to integrate ICT. These initiatives may include training programs, the purchase of new technologies or the implementation of new teaching methods.

2.3. Key Integration Factors

The followings are the identified key factors of ICT integration:

- Leadership model: This is the style or approach adopted by the leader to guide and influence ICT integration. This can vary from transformational to technological leadership, depending on how the leader motivates and engages stakeholders.
- Infrastructure and resources: This refers to the availability and quality of technological equipment, as well as the financial, human and material resources needed to support ICT integration.
- Professional development: This concerns the training and capacity building of academic and administrative staff to use ICT effectively in their jobs.
- Pedagogical change: Here, we look at how ICT modifies or improves teaching and learning methods.
- Resistance to change: This factor recognizes that any change may encounter resistance. It involves identifying and overcoming obstacles or reluctance to adopt ICT.
- Policy and implementation strategy: This refers to the rules, regulations and guidelines that guide the way ICTs are integrated and used.
- Progressive evaluation of ICT use: This factor focuses on the evaluation and regular monitoring of the effectiveness and impact of ICT once it has been integrated.

2.4. Successful integration of ICT at the school

This is the desired outcome of the process. If the preceding steps are well managed and executed, the school should experience successful ICT integration, characterized by effective and innovative use of technology to enhance teaching and learning.

In short, this conceptual framework illustrates the logical sequence and relationships between leadership policies, integration initiatives, key integration factors, and the end result of successful ICT integration. It serves as a guide to understanding and exploring how and why some ICT integration initiatives succeed, while others encounter challenges.

3. Conclusion

This comprehensive analysis of ICT integration in higher education in Antsiranana reveals multifaceted dimensions crucial for educational advancement in Madagascar. The findings underscore the pivotal role of effective leadership in fostering digital transformation within higher education institutions. It is evident that the success of ICT integration heavily relies on the synergy of several key factors: visionary leadership, robust infrastructure, targeted professional development, innovative pedagogical approaches, overcoming resistance to change, clear policy formulation, and strategic implementation.

The insights gained highlight significant challenges, including resource limitations and resistance to change, yet also unveil substantial opportunities for enhancing the quality of education and positioning Antsiranana's higher education at the forefront of digital learning. The study posits that addressing these challenges through informed policy-making, strategic resource allocation, and stakeholder engagement can catalyze the effective integration of ICT.

In light of these findings, the paper recommends a holistic approach that encompasses strong leadership commitment, continuous professional development, and active collaboration among educators, policymakers, and the community. Future directions should focus on longitudinal studies to assess the long-term impact of ICT integration and explore innovative models that can be scaled and adapted to broader contexts within Madagascar.

In conclusion, the successful integration of ICT in higher education in Antsiranana is not just a technological upgrade but a transformative journey that requires comprehensive planning, collaboration, and a deep understanding of the educational ecosystem. It is a path that, if navigated effectively, can significantly enhance educational outcomes and set a precedent for other regions in Madagascar.

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