Doctor of Philosophy

Success Factors for E-Learning Systems Implementation In Developing Countries: The Case of Higher Education Institutions in Gabon

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Success Factors for E-Learning Systems Implementation In Developing Countries: The Case of Higher Education Institutions in Gabon

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Declaration

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Dedication

This work is dedicated to:

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My lovely wife Lusia, who suffered greatly from my absence and has been taking care of my children since the day I started this PhD journey. No words in the world can help me express my gratitude, appreciation and love for you.

Abstract

As information and communication technologies (ICT) are increasingly integrated into societies around the world, their effects are clearly visible on people's lives as well as on the economy of countries. The use of ICTs in developing countries like Gabon is considered a necessity to overcome the many challenges encountered in all sectors in general, and in education in particular. The use of ICT for education is called "e-learning", which could be defined as teaching and learning using electronic media to access the educational program, remotely without the need for a traditional classroom. E-learning systems are constantly mentioned as a solution in higher education in Gabon facing many problems such as an insufficient number of teachers and facilities, a limited number of seats in classrooms and outdated course content, to name a few. However, adopting e-learning technology as an educational system without a real plan can be very costly in terms of resources (skills, time, money and energy). Thus, the objective of my research is to study the success factors of e-learning systems, both on the side of users (students, teachers and technical staff in Study 1 and on the side of providers (universities and government institutions) in Study 2.

Since the success of e-learning systems is almost always attributed to technology, Study 1 aims to analyze the factors affecting Perceived usefulness and Use for the effectiveness of e-learning systems, combining technological factors (system quality, information quality, and service quality) and factors related to people personality traits or individuals' characteristics (prior knowledge, self-regulated learning, and consistency of interests). This has been suggested by previous research. A mono-method approach, a quantitative methodology and a structured survey questionnaire were used to collect data from around 400 respondents (students, teachers and technical staff in some universities in Gabon); then, the data collected was analyzed using structural equation modeling (SEM) and the results showed that there were significant relationships between the variables and factors of the model. The results and conclusions of the study confirmed the influence of technological factors on perceived usefulness and use and revealed the important role of individuals' characteristics in the success of e-learning systems. Researchers are encouraged to pay more attention to the characteristics of individuals in future research.

The success of e-learning systems also depends on a sustainable business plan and organizational readiness measured in terms of technical, content, human and financial resources. Thus, Study 2 aims to investigate the frameworks for creating a successful e-learning business model for good return on investment by combining the Business Model Canvas (BMC) and Technology Roadmap (TRM) tools. A literature-based case study using popular e-learning platforms such as edX, Coursera, and Udacity helped

me gain more specific insights through an interview with a panel of potential users and business experts from two different universities in Gabon. BMC and TRM were developed separately but simultaneously, then linked together and applied to the considered SCIENTIA case study. The BMC was developed for a medium-term period (four years), the information gathered was used in the construction of the TRM and the final product was presented. The conclusions of the research are drawn on the basis of the results of the two studies, contributions, limitations and future recommendations are then discussed in detail.

Keywords: e-learning systems, e-learning systems success, e-learning systems business model framework, perceived usefulness, business model canvas, technology roadmap

Table of Contents

List of Tables

List of Figures

CHAPTER I: Introduction

1.1. Background and purpose of the study

Information systems are increasingly used by organizations around the world to improve their decision-making and productivity, and create benefits for stakeholders such as employees, staff and customers. Today, the applications of information systems and technologies are visible in many different sectors such as commerce (e-commerce), banking (e-banking), health (e-health) and education (e-learning). The use of ICT's (information and communication technologies) for education is called e-learning, which could be defined as teaching and learning using electronic media such as the Internet to access the educational curriculum, remotely without the need for a traditional classroom.

Indeed, online learning or e-learning is increasingly seen as a cheaper and more flexible alternative to traditional school, as it helps increase the number of people with access to higher education, especially in developing countries or marginalized groups in rural areas (Annika and Å ke, 2009). E-learning systems are indeed increasingly in demand in schools, not only to enable more people to access education at lower cost, but also to enable distance education with the advent of the COVID-19 pandemic, which forced so many people to stay at home for several months between 2020 and 2021, in many countries around the world. Added to the competition which is now global and increasingly fierce, it is becoming urgent for universities to adopt e-learning to allow more people to have access to knowledge without being limited by distance, space or time (Rohayani et al., 2015). In some countries like Gabon, where I conducted the research, e-learning systems are perceived as an alternative to traditional classrooms facing overcrowding. Therefore, the need to study the determinants of the effectiveness of e-learning systems, both managerially and academically, is growing.

According to previous studies, Perceived Usefulness and Usage are two major concepts that have proven to be instrumental in measuring the effectiveness of e-learning systems. For Davis (1989), Perceived Usefulness is the degree to which a person believes that using a particular system would improve their job performance. However, Usage (Use) measures how often an information system is used, measured by the number of times users access the systems in a day or week (Davis, 1989; DeLone & McLean , 2003a; Urbach, Smolnik, & Riempp, 2010).

Additionally, several antecedents affecting Perceived Usefulness and Usage were investigated. According to Alsabawy et al. (2016), typical antecedents affecting perceived usefulness are IT Infrastructure Services, System Quality and Information Quality; their effects are mediated by Service Delivery Quality. For the Use construct, according to the models proposed by DeLone and McLean

(2003) and Urbach et al. (2010), typical antecedents are Collaboration quality, Service quality, Information quality, and System quality. So obviously, until now, studies on factors affecting Perceived Usefulness and Usage have focused on technological aspects, ignoring individuals' characteristics that might also affect these two major constructs Alsabawy et al. (2016). The characteristics of users (students, teachers and staff) affecting Perceived Usefulness and Use are much more studied in developed countries than in developing countries (Annika and Å ke, 2009).

Moreover, previous studies on the success factors of e-learning systems have mainly focused on students' perception and on a single university or institution. Since there is a lack of research that combines technological and individuals' characteristics as antecedents of Perceived Usefulness and Use, one of the main purposes of my work is to expand knowledge about the success factors of e-learning systems by including these individuals' characteristics variables. Therefore, System Quality, Information Quality and Service Quality (technology) and Prior Knowledge, Self-regulated Learning and Consistency of Interest (Individual characteristics) are proposed as determinants of Perceived Usefulness and Use.

Apart from the very small number or the lack of studies that focus on individuals' characteristics as success factors of e-learning systems, the literature review also revealed that the majority of studies that have been done in this field have focused on the perception of users (Davis, 1989; DeLone & McLean, 2003a; Urbach, Smolnik, & Riempp, 2010), i.e. students, teachers and staff, but very few have considered the perception of the providers of these e-learning systems, i.e. private schools or public institutions.

Even though today more and more students, teachers and staff are using e-learning systems because they believe it will improve their professional performance, the willingness and the ability of the providers to install and maintain such systems for years should also be considered. Indeed, installing and maintaining an e-learning system for years requires significant human, material and financial resources. It is therefore important to plan such a project well in advance in order to avoid a failure that will be difficult to bear, especially for developing countries or emerging educational institutions that do not have a lot of means.

Since there is a lack of studies talking about the perceived usefulness of e-learning from the perspective of providers, the second main objective of my work is to expand knowledge about the success of e-learning systems by including business variables. Therefore, the Business Model Canvas (BMC) and the Technology Roadmap (TRM) are offered as two valuable tools to assess the effectiveness of e-learning implementation and a sustainable business model framework for a successful e-learning system will be offered.

To be able to achieve the two main objectives of my work, I decided for more efficiency to divide the work into two major studies: the first study to answer the question if individuals' characteristics of users could also influence the two major concepts Perceived Usefulness and Use that help to assess the success of e-learning systems and the second study to be able to understand which business factors can also contribute to the success of the implementation of e-learning systems. The whole work will be presented as follows.

My work is divided into several chapters. The Chapter I is essentially the introduction which serves as an overview of my work and talks about the key points that will be discussed. In Chapter II, I will present the context of the research and talk about Gabon, which is the country in which I conducted the research questionnaire. I will talk about the education system in general and its challenges, the challenges of higher education, the development of ICTs in Gabon, the current level of infrastructure and telecommunications services, as well as the strategies put in place by the country to promote the use of ICT in higher education. This is followed by the statement of the research problem and the research questions. I will conclude this chapter by talking about the objectives and the significance of my work.

The third chapter deals with the literature review and the main research concepts. After a quick overview of traditional learning, I will discuss e-learning, its definition, its history, its applications, its advantages and its different modes of delivery. This literature review will also help to see some case studies before talking about the challenges of implementing e-learning systems. I will then see the success factors of e-learning systems with the concepts of Perceived Usefulness, Types of learning behavior, Prior knowledge and Grit. After that, I will discuss two major concepts of business management which are the Business Model Canvas (BMC) and the Technology Roadmap (TRM), and then more importantly how they can be combined to create a sustainable e-learning business model.

Chapter IV gives an overview of the research methodology and the theories used for my work. As I said before, the work was divided into two major studies. Thus, Chapter V deals with the research methodology of study 1 (research hypotheses and model, sampling and measurement items, data analysis and results, conclusion and discussion), and then Chapter VI deals with the methodology research of study 2 (building process integration of business model canvas and technology roadmap).

Finally, Chapter VII presents the summary and conclusion of the research, discusses the contributions of my work, and suggests future research projects.

CHAPTER II Overview and context of the research

2.1 Gabon: country profile

2.1.1 Geographic framework

With an area of 267,667 square kilometers (nearly 268,000 km^2), Gabon is one of the smallest African countries, but larger than many other countries like São Tomé and Príncipe (1,001 km^2), Gambia (11,295 km^2), Rwanda (26,338 km^2), Burundi (27,834 km^2), Equatorial Guinea (28,051 km^2), Malawi (119,310 km^2) and Ghana (238,537 km^2) (Meyo and Nzamba, 1990).

Crossed by the equator, Gabon is located in Central Africa between three countries and an ocean: Cameroon and Equatorial Guinea to the north, and the Republic of Congo to the east and south. The Atlantic Ocean stretches along its western side, with approximately 800 kilometers of coastline (Bah-Lalya and Yénikoye, 2011).

Figure 2.1: Location of Gabon on Africa map

With an estimated population of 2,279,000 people (World Bank data, 2022), Gabon has a hot and humid equatorial climate, with alternating dry and rainy seasons throughout the year. The country is home to forests where the flora and fauna are still well preserved with significant areas of protected parks. The Ogoué River, with its tributaries, navigable over 1200 km, crosses the country from west to east.

The soil is rugged, with three characteristic areas: a coastal plain to the west, plateaus to the north and east – including the Batéké plateaus – and mountain ranges including the famous Mont Chaillu. The

mountainous part is a veritable water tower for the sub-region and is the starting point of the mountain range which culminates at Mont Iboundji, at an altitude of 1,575 m. Despite its accelerated urbanization, the country still has an enormous vegetation cover, represented by 85% of tropical forests, including 35% of primary forests that are still underdeveloped today.

The country has immense potential with a subsoil in which there is oil, but also uranium, manganese, niobium, phosphate, gold and other natural resources. The forest cover, composed mainly of Okoumé, is estimated at 22 million hectares with around 12.5 million CFA francs of commercial value. The country has 6,000 plant species, 19 primate species, 20 predatory species and more than 600 bird species. The rivers and the maritime coastal zone are home to a very diverse fish population.

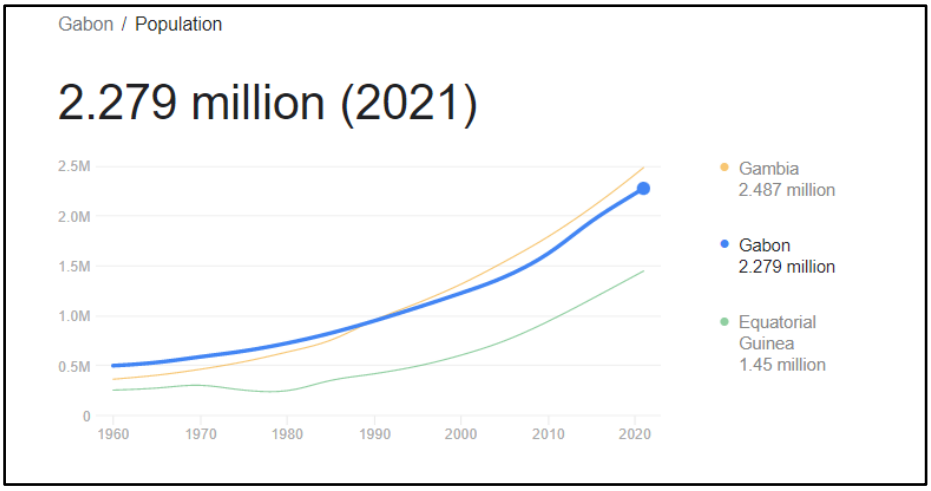


Figure 2.2: Gabonese population from 1960 to 2020 (World Bank data, 2022).

2.1.2 Peoples and cultures

According to the Association for the Development of Education in Africa (Bah-Lalya and Yénikoye, 2011), Gabon was inhabited in successive waves. The first inhabitants were the Pygmies, then, in large numbers, the Bantu, today the majority. The latter are divided into about forty ethnic groups with nine main ethnolinguistic groups: the Fangs (36%), the Mpongwé (15%), the Mbédé (14%), the Punu (12%), the Bandjabi, the Bakota, the Obamba and the Batéké. Pygmies make up just under 1% of the population.

ADEA study states that the first Europeans, the Portuguese, anchored on the coast in the 14th century. Yet it was France that colonized the country following a treaty signed with Chief Mponguwe on February 9, 1939. Gabon gained its independence on August 17, 1960. At the time, it was one of the

African countries least densely populated, with a population of 448,564. This number has gradually increased over the years to reach 552,184 in 1970, 1,014,976 in 1993 and 1,330,000 in 2002. The current density is 3.8 inhabitants per km^2.

The male-to-female ratio is approximately 102 females for every 100 males. The foreign population is estimated at 15.2%. The average annual growth rate is 2.5%. The Gabonese population is very young with those under 15 representing 41% of the total. The active population (16-55 years old) is estimated at 500,000 people and is concentrated in Port-Gentil and Libreville where most rural and foreign emigrants live. Life expectancy in Gabon is now estimated at 66.84 years, greater than ten years before, 64.40 years in 2012.

2.1.3 Political and economic framework

The information collected on the political and economic situation in Gabon is very recent (Oct. 26, 2022) and comes from the website of the World Bank, which has a permanent headquarters in Libreville, Gabon (https://www.banquemondiale.org/fr/country/gabon).

Political situation

The Gabonese Democratic Party (PDG) has dominated Gabonese political life for 54 years. President Ali Bongo Ondimba succeeded his father Omar Bongo Ondimba in 2009 and was re-elected in August 2016 in a highly controversial election marked by a relatively low voter turnout (59%). Less than a year from the end of the presidential term, Gabon is preparing for several deadlines, including the presidential and legislative elections, scheduled for 2023.

Economic situation

As the fourth largest oil producer in sub-Saharan Africa, Gabon has recorded strong economic growth over the past decade, driven in particular by oil and manganese production. In 2020, the oil sector represented 38.5% of GDP and 70.5% of exports despite the efforts made to diversify the economy.

Forecasted at 3.4% before COVID-19, Gabon posted growth of -1.8% in 2020. The restrictive measures to fight the pandemic and the fall in the price of oil in 2020 had the consequences, the rise in unemployment, the significant drop in the mobilization of domestic revenue, followed by the drop in exports and foreign direct investment, resulting in a significant fiscal deficit. According to the United Nations, job losses were over 104,000 in 2020.

Table 2.1: Gabon major macro economic indicators (World Bank data, 2022).

MAJOR MACRO ECONOMIC INDICATORS

	2020	2021	2022 (e)	2023 (f)
GDP growth (%)	-1.9	1.5	2.8	3.7
Inflation (yearly average, %)	1.3	1.1	2.9	2.6
Budget balance (% GDP)	-2.2	-1.5	1.6	2.5
Current account balance (% GDP)	-6.9	-5.2	0.8	-1.1
Public debt (% GDP)	78.3	65.8	52.6	50.8

(e): Estimate (f): Forecast

Forecasted at 3.4% before COVID-19, Gabon posted growth of -1.8% in 2020. The restrictive measures to fight the pandemic and the fall in the price of oil in 2020 had the consequences, the rise in unemployment, the significant drop in the mobilization of domestic revenue, followed by the drop in exports and foreign direct investment, resulting in a significant fiscal deficit. According to the United Nations, job losses were over 104,000 in 2020.

Economic outlook

In 2022, the economy, supported by stronger external demand and higher oil prices, gradually recovers despite the impact of the war in Ukraine. The fiscal balance is expected to increase gradually over the medium term, but the rising cost of living could increase household vulnerability. According to the latest estimates, growth should reach 2.7% in 2022 thanks to the good performance of the oil, mining and timber sectors. In addition, the public debt ratio should stand at 58.3% of GDP in 2022.

Table 2.2: Gabon economic strengths and weaknesses (World Bank data, 2022).

STRENGTHS	WEAKNESSES
• Abundant natural resources: fourth-largest oil producer in sub-Saharan Africa (2020), second-largest manganese producer in the world (2022) and one of the continent's largest producers of tropical wood • Under-exploited mining potential: deposits of iron, gold, uranium, diamond, copper, zinc, rare-earth metals, etc. • Drive to diversify the economy as part of the Emerging Gabon Strategic Plan 2010-2025 • Hydroelectric potential • Member of the CEMAC and the Commonwealth	• Economy heavily dependent on the oil sector • High cost of production factors linked to inadequate infrastructure (transport and electricity) • Dependent on imports of food and capital goods • High unemployment, endemic poverty, poor wealth distribution, informal economy (estimated at between 40% and 50% of GDP) • Widespread corruption • Stock of domestic and external arrears not yet cleared

2.2 Education system in Gabon

2.2.1 Education system overview

The place and orientation given to education and training in Gabon during the colonial period were designed to respond to the interests of the French colonial system established in the country. When independence was proclaimed, the highest diploma that could be obtained in Gabon was the baccalaureate, awarded at the end of secondary school. The training of high-level executives took place in universities and Grandes Ecoles in France.

Primary education

Education in Gabon is still largely based on the French model, although things are gradually changing. The medium is also always the French language too, and school is compulsory between the ages of 6 and 16. After perhaps spending time in crèche and kindergarten, 6-year-old children enroll in primary school for 6 years of basic education. Although they can obtain a "certificat d'etudes primaires" certificate, it is their results in "concours d'entrée en sixième" examination that determine the quality of the secondary school to which they will subsequently be directed.

Secondary education

There are several types of secondary schools in Gabon, of which general and technical establishments are the most common. Others include private and international schools. The state program takes 7 years to complete. After 4 years, the students take their "brevet d'études du premier cycle" exam. At the end of the period, they obtain a "baccalauréat".

Professional training

Vocational and continuing education for adults is the responsibility of the Ministry of Technical Education and Vocational Training. Its main role is to suggest strategies that reintegrate citizens into the most important sectors of the economy.

Tertiary education

There are a variety of higher education institutions in Gabon, including national schools and higher institutes. The 2 state universities are the University of Science and Technology of Masuku, and Omar Bongo University. The latter which is illustrated here was founded in 1978 and is based in Libreville. Its departments include the Faculties of Administration, Engineering, Forestry, Hydraulics, Law, Literature, Management, Science, and Teacher Education.

Universities in Gabon

This list includes universities, colleges, vocational schools, and other institutions of higher education.

Table 2.3: List of universities in Gabon

University	English Name	City
École Nationale des Eaux et Forêts	National School of Water and Forests	Libreville
École Normale Supérieur	Normal Superior School	Libreville
École Polytechnique de Masuku	Polytechnic School of Masuku	Franceville
Institut National des Sciences de Gestion	National Institute of Management Sciences	Libreville
Institut National Supérieur d'Agronomie et de Biotechnologies	Higher National Institute of Agronomy and Biotechnology	Franceville
Institut Supérieur de Technologie	Higher Institute of Technology	Libreville
Institut Universitaire des Sciences de l'Organisation	Universitary Institute of Management	Libreville
Université des Sciences de la Santé	University Of Health Sciences	Owendo
Université des Sciences et Techniques de Masuku	University Of Science And Techniques Of Masuku	Franceville
Université Omar Bongo	Omar Bongo University	Libreville

2.2.2 Challenges of the Gabonese education system

The problems of the Gabonese education system (pre-primary, primary, secondary and higher education) were identified during the General Education Assembly in 1983. However, these problems still remain unresolved despite the efforts made by the government and its partners. The problems are almost the same at all levels, from primary schools to universities.

Despite the low level of public resources allocated to education, gross and net enrollment rates (respectively 137.2% and 91.5% in 2002) have continued to increase (Bah-Lalya and Yénikoye, 2011). So one of the greatest challenges of the Gabonese education system is the insufficient number of school equipment and vocational training structures at the end of each level and also old and unsuitable premises.

Added to this is the obvious quantitative and qualitative lack of teachers. For example, in 2001, the Ministry of National Education had 2,190 secondary school teachers: 62.5% of them had no pedagogical training, particularly those who taught mathematics (77.5%), physical sciences (79.8%) and French (66.7%) (Bah-Lalya and Yénikoye, 2011). Moreover, only 21.1% of these teachers are Gabonese. The

overrepresentation of foreign teachers is particularly notable in mathematics (86.3%), physical sciences (86.3%) and French (69.3%).

We therefore find classes with 50 pupils on average, with many areas where we have classes of 80 or even more than 100 pupils per class. This situation is amplified by the phenomenon of massive rural exodus. What then happens to the other 1,500 graduates that the Gabonese education system produces each year? Are they going to study abroad? Few people can afford to send their students abroad to pursue higher education (Kiemi, 2021).

Last but not least, the situation of children with special needs should also be considered. Gabon considers as disabled "*any person who, suffering from a physical, sensorial or mental deficiency, congenital or accidental, experiences problems in carrying out his normal functions*". At present, there is no reliable data to know the number of disabled people, their distribution by age or gender.

During the General Orientation of Education, Training and Research in 2012, the desired innovations concerned governance, curricula and classroom practices (Mba, 2021). The targeted governance concerns the search for a ratio of 35 pupils per class by 2020, quality school performance with a view to social equity and equal opportunities between learners, the creation of specialized institutions for promoting the schooling of students with disabilities and the search for inclusion strategies through literacy and non-formal education.

2.2.3 Challenges of higher education in Gabon

The Gabonese population growth comes with many challenges in sensitive areas such as housing, demography, health, justice and education, to name just a few. This increase of the population, as well as the increase of the literacy rate, led to the fact that today there is a high demand in higher education.

This high demand is essentially justified by, but not only, the fact that each year secondary schools produce more and more graduates. For instance, in May 2010, the Ministry of National Education identified the main weaknesses of the professional training infrastructure in Gabon, that are obsolete equipment and programs as well as an insufficient number of facilities and limited seating capacities (UNESCO, 2015).

"Higher education comprises all post-secondary education, training and research guidance at education institutions such as universities that are authorized as institutions of higher education by state authorities"(IFIC/JICA, 2004). Today, worldwide in general and on the African continent in particular, especially in Gabon, higher education is subject to great challenges and is influenced by several factors. First, at the end of the 20th century the world went from an economy that produces value across the use

of material and human capital and the exploitation of raw materials at very low costs to an economy that produces value through developed information systems: collection and processing of information for the creation of "knowledge" and innovation. Higher education is then forced to put in place infrastructures and produce people capable of creating this knowledge-based economy.

The second factor is globalization, which is the connection of different parts of the world resulting in the expansion of international cultural, economic, and political activities. It is the movement and integration of goods and people among different countries (Wikipedia). This big and rapid movement of people, goods and information around the world is increasingly leading to the relocation of companies in search of a cheaper workforce. These companies once in African countries need a skilled and well-trained workforce. This requires higher education institutions to update the content of the courses that are provided in faculties and laboratories to produce talents that are in tune with the needs of multinational corporations.

The third factor is the increase in demand in higher education. Indeed, in Gabon for example, according to Index Mundi's website, the literacy rate went from 63.2% in 1995 to 89% in 2011, before falling slightly (83.2%) in 2015. From higher education reserved for a certain elite, we moved to a mass higher education.

Furthermore, even if it's easy to see that today higher education is widespread due to massive investments in the national education system by the government, it is also easy to see the gap that exists between Gabon and developed countries, rich and poor people, between genders, between the capital city and rural areas, and even between certain ethnic groups. Thus, to solve all these challenges higher education is facing, the Gabonese government must respond effectively and quickly. With an increasingly large and educated population, it is urgent to build a system that improves higher education access (both financially and in terms of infrastructures through new content tailored to the needs of businesses), but also on the demographic and geopolitical level, so that all persons entitled to higher education can have access to it throughout the country.

Gabon must quickly find suitable and sustainable solutions to offer higher education to its population, even if as a short-term solution, thanks to very good international relations, the government grants cooperation scholarships and enrolls its students on all continents and in more than 60 countries around the world, such as China (Kiemi, 2021) and South Korea for example. It's true that some wealthy parents can also afford to send their children abroad for a better education, but barely 2 to 3% of the population can afford it.

To deal with this situation, several voices are rising to suggest possible solutions; in particular two important voices going in the same direction. First, the President of the National Assembly of Gabon, who, disappointed by the plethora of students encountered in the universities and institutes, proposed the use of ICTs in order to solve the problem (Freddy, 2019). Secondly, during a Task Force on Education UNESCO suggested to Gabon priority tools for improving the education system and achieving the Sustainable Development Goals 4, in particular the development of the education sector, the establishment of an information system for education management (EMIS), the integration of ICTs in the education system as well as adaptation to contemporary challenges" (UNESCO, 2018).

2.3 ICT developments in Gabon

2.3.1 e-Government development

E-Government (e-Gov) refers to the use of ICT as a platform for the exchange of information, the provision of services and transactions with citizens, businesses and other branches of government (Al-wazir and Zheng, 2012). The impact of e-government on good governance in developing countries is now a certainty. Thus, Gabon is committed to the development of e-Government through a national plan.

In addition, two Gabonese researchers, Pierre M. Mbindzoukou and Marcien Mackaya, conducted a research entitled "*Overview of e-Government Development in Gabon*" with the aim of evaluating and analyzing the state of e-Government in Gabon, on the one hand, and to highlight the challenges that await the country to achieve this ambition, on the other hand.

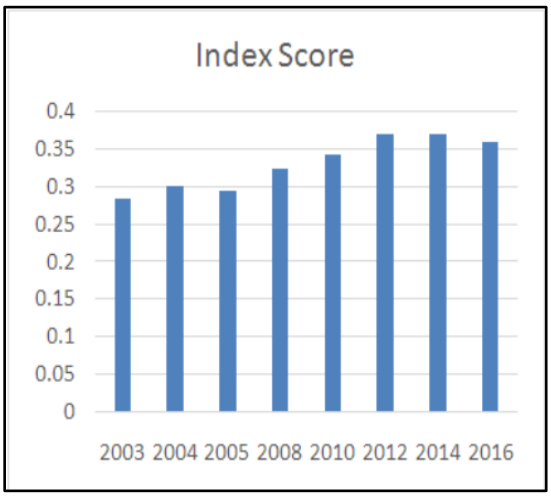
For the United Nations (UN) organization, e-government can be defined as "the use and application of information technology in public administration to streamline and integrate workflows and processes, effectively manage data and information, improve the delivery of public services, as well as expand communication channels for the engagement and empowerment of people".

Based on data collected primarily from the United Nations, e-Government surveys and other surveys provided by the Electronic Communications and Postal Regulatory Authority (ECPRA) in Gabon, Moukeli and Mackaya (2017) assessed e-Government indicators in Gabon by comparing them to those of certain countries in the sub-region, whose situation is comparable, such as Congo Brazzaville and Cameroon (two bordering countries with the same economic structures but a higher population) and also Kenya (one of the top 10 African countries in e-Government).

To carry out their study, they used the universally accepted comparison indicator defined by the United Nations: the E-Government Development Index (EGDI) which is dedicated to the evaluation of

the development of e-Government at the national level and is a composite index based on three standardized indices: Telecommunications Infrastructure Index (TII) based on data provided by the International Telecommunications Union (ITU); Human Capital Index (HCI) based on data provided by the United Nations Educational, Scientific and Cultural Organization (UNESCO), and Online Service Index (OSI) based on data collected from an independent survey questionnaire that assesses the national online presence of all 193 United Nations member states. A supplementary index to the UN e-Government Survey is the E-participation index (EPI) which focuses on the use of online services to facilitate the provision of information by governments to citizens' interaction with stakeholders and engagement in decision-making processes.

To better assess the Gabon's e-Government development index, the comparison was made with other countries with the same level of development and the results are presented as follow:



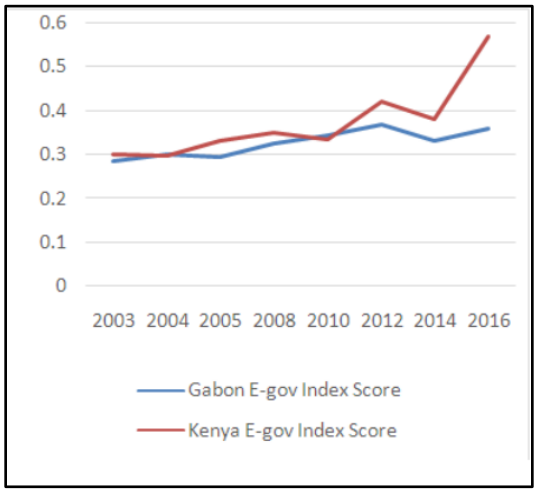


Figure 2.3: Gabon e-Government Index Trend. **Figure 2.4: Gabon and Kenya e-Government Index Trends.**

The comparison between the e-Government indices of Gabon (Figure 2.3) and those of Kenya (Figure 2.4) shows that Kenya, which has undergone significant progress since 2006, was overtaken by Gabon in 2010; but the former overtook the latter after 2012 and the gap in e-Government development between the two countries has been constant ever since. Figure 2.5 illustrates the comparison between Gabon e-Government Index trend and other countries. The position of Cameroon and Congo in the ranking remained constant over the same period, probably because the development of their e-Government indices did not allow a significant evolution of the ranking compared to other countries.

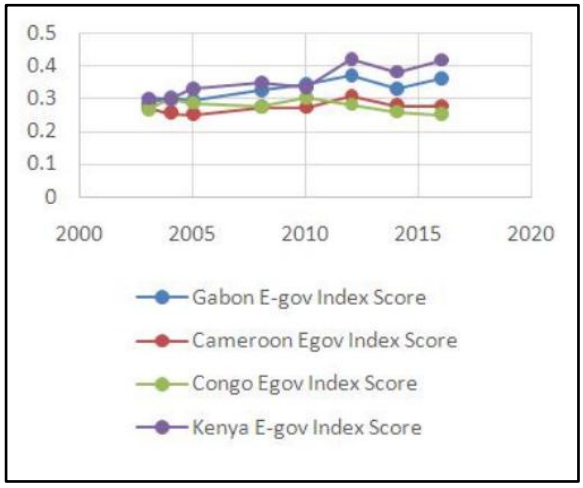


Figure 2.5: Gabon and other countries e-Gov Index Trend.

Finally, Table 2.4 and Figure 2.6 give us more insights about the evolution of e-Government Indices of Gabon and other countries. This shows that Gabon's EGDI needs to be improved to at least 0.4 in the next few years, and more efforts need to be made towards the telecommunication infrastructure index and online service index which have a lower rank than human capital index.

Table 2.4: E-Gov. Indices of Gabon and other countries

Index	Gabon	Cameroon	Congo	Kenya
EGDI	0,3584	0,2759	0,2497	0,4186
OSI	0,1522	0,2174	0,0435	0,558
TCII	0,3068	0,131	0,1713	0,1808
HCI	0,6162	0,4794	0,5344	0,5169
E-part. Index	0,0678	0,1695	0,0847	0,5254

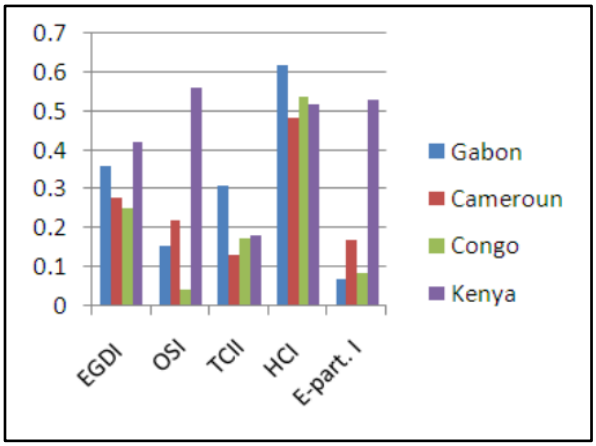


Figure 2.6: E-Gov. Indices of Gabon and other sub region countries

2.3.2 Online services in Gabon

In the same research conducted by Moukeli and Mackaya (2017), we note that in Gabon's national development strategy, detailed in an official document called "Plan Stratégique Gabon Emergent", e-Government is divided into three sections:

- A “front office” platform made up of online services for citizens and businesses;
- A "back office" platform made up of business and administrative applications, services and collaborative tools to improve the productivity of administrative staff;
- Dashboards and decision support tools for government decision makers.

Many efforts have been made on the front office side, in particular through the creation of a government web portal (http://www.gouvernement.ga), which offers links to the websites of all Ministries and main town halls. We can now see the development of interactive applications such as e-visa (http://www.dgdi.ga) for the online entry visa to Gabon and e-tax (http://www.etax. dgi.ga) for the online visa declaration and payment of taxes.

Despite these considerable efforts, much progress remains to be made in the development of the applications identified by the National Information System Master Plan on the one hand, but also transactional applications such as e-tax, mainly due to the lack of investment budgets, little dynamism of the private sector in the development of services and the lack of incentives from public authorities. Figure 2.7 shows a comparison of online service trends between Gabon and selected countries in the categories of emerging information services, enhanced information services, transactional services and connected services.

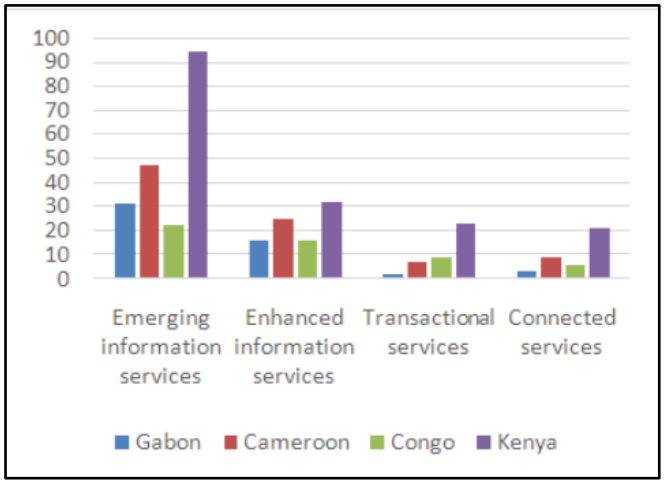


Figure 2.7: Online Service gap between Gabon and the other countries in the region

2.3.3 Current status of ICT infrastructures

Aware of the socio-economic benefits linked to information and communication technologies, Gabon has invested massively since 2012 in the construction of a high-speed fiber optic network.

According to the International Telecommunication Union (ITU), the United Nations specialized agency for information and communication technologies, Gabon gained 10 places in 2017 in the world ranking of ICT and is now the sixth country the most connected on the African continent. This may be the reason for the drop in the cost of Internet access and the increase in the number of subscribers over the same period.

According to the Electronic Communications and Postal Regulatory Authority (ECPRA), there are about 8 private companies, Internet service providers in Gabon; among them, four active mobile operators: Airtel, Gabon Telecom, Azur and Moov. It should be remembered that mobile operators provide both telephony and Internet services. Table 2.5 illustrates the main indicators of telecommunications technology over the period 2011-2014 (ECPRA data).

Thanks to the development of 3G and 4G technological networks in 2016, significant progress has been made in individual broadband Internet connectivity, which was still modest in 2014 (Figure 2.8). Mobile telephony has made fixed telephony increasingly marginal and reserved for administrations and businesses. Its expansion is currently very limited, despite the efforts of Gabon Telecom, the only operator in this field, to encourage subscription to fixed telephones, with incentives such as free communications between fixed telephones.

Gabon has one of the highest mobile penetration rates in the region. In March 2016, the overall volume of Internet subscriptions in Gabon was 1.1 million, with a penetration rate of 72.56%, according

to data published by the Electronic Communications and Postal Services Regulatory Agency (ECPRA). However, the Government will have to continue its efforts in the construction of infrastructures, in particular the fiber optic broadband network on the whole of the territory on the one hand, but also the construction of a data center which will make it possible to secure the data of hosting and promoting the application development.

Table 2.5: Main statistical indicators of ICT development: 2011 – 2014 (ECPRA)

Indicators	Unit	2011	2012	2014
Internet				
Mobile internet park	Number		461461	1106552
Fixed internet park	Number		25983	10737
ISP internet park	Number		9927	33525
Global internet park	Number	282776	497371	1150814
High bandwidth Park	User	6651	NC	13767
Low bandwidth Park	User	276125	NC	1015047
Internet penetration rate	User/ Population	17,78%	33%	76%
internet ARPU	FCFA	5636	NC	NC
Mobile phone				
Mobile phone park	Number	2370227	2520027	2932731
Mobile phone penetration rate	User/ Population	97%	166%	193,39
Mobile phone ARPU	FCFA	6375	6403	5884
Fixed line				
Fixed lines	Number	22499	22611	18498
Penetration rates fixed lines	User/ Population	1,41%	1,49%	1,22%
FixedlinesARPU	FCFA	63296	54186	40568

N.B. *- ARPU: Average Revenue Per Unit/User.*
- ISP: Internet Service Provider

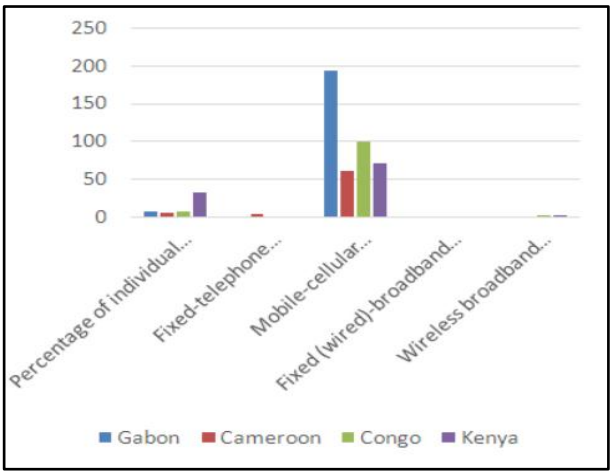


Figure 2.8: ICT gap between Gabon and other countries in the region.

2.3.4 ICT teaching in higher education

Over the past ten years, the Gabonese state has invested a lot of money and time in the development of digital technology throughout the territory. Despite this, the level of development of ICT in Gabon is well below the western countries level and is not even part of the top 10 of the most developed African countries in terms of ICT or e-government.

To make up for this delay, although the country needs new universities, the government must above all invest in revitalizing the already existing digital ecosystem, which consists of:

1. INPTIC (Institute of Posts and Telecommunications), which houses a digital laboratory as part of the Train My Generation project;
2. Higher Institute of Technology (IST) based within the Basile Ondimba vocational training center;
3. ITO (Technological Institute of Owendo), which is located during the technical high school and is appropriate to house a FabLab and can facilitate the digital transition between its secondary technical laboratories (LTNOB) and the technical laboratories of higher education (I.T.O, INPTIC, IST…);
4. A Communication Department at the University Omar Bongo to which is added the laboratory of the AUF (Agence Universitaire de la Francophonie) both based within the UOB;
5. Incubators with expertise in the field (Ogooue-Labs through its "Ecoles 241", SING, Cyberschool, Entrepreneurship, etc.);
6. Existing private colleges, such as Digital Business School;
7. Existing programs, such as eGabon or Subsequent future, etc…
8. Work to create a national Data Center as is the case with the Diamniadio Data Center in Senegal.
9. The African Institute for Computer Technologies (IAI), based in Libreville, has trained a large portion of the computer executives and technicians of francophone Africa. Former students and professors have been central to the creation of university departments and specialized schools in the sub-region.

The results obtained by Kenya prove that the strategy put in place is a win-win situation. To improve its index, Gabon will have to continue implementing its strategic plan with the inclusion of citizens, in particular the networking of the entire territory with fiber optics, the construction of a data center, the optimization of the exchange point Internet, the regulation of the sector by the proposal of laws and the development of digital entrepreneurship.

2.4. Problem statement and research questions

Faced with all these problems encountered in higher education in Gabon, in particular the low number of teaching structures and the problem of overcrowding in classrooms, online learning systems appear to be effective and sustainable solutions.

However, some organizations have invested huge amounts of money in their e-learning projects, believing that having a high-performing e-learning system will be enough to motivate people to perceive it as a useful alternative to traditional classrooms and actually use it. But this is not always the case (Crawford & Persaud, 2012). Some people still prefer traditional classroom learning to e-learning systems, not only for technological reasons, but also for some reasons related to their individual characteristics.

Moreover, adopting e-learning technology as an educational system without planning can be very costly in terms of time, money and energy (Rohayani et al., 2015). Although many organizations today recognize the benefits of e-learning systems, many are still hesitant to take action and actually invest in installing these systems. Each institution, according to its means, must ask itself the questions: are we ready to install and maintain this technology? Can we do it? If so, how are we going to do it? Are we strong enough to beat the competition?

So before considering the installation of an e-learning system for higher education in Gabon, it would be wise, first of all, to know the perception of users (are they ready to consider these e-learning systems as effective as classroom learning?), and on the other hand, to examine what could be an effective business model so that the providers of these e-learning systems find it useful and urgent to invest the means required.

My work being divided into two studies, the first one will help me answer the questions:

- What factors affect Perceived Usefulness and Usage for the effectiveness of e-learning systems?
- Do individual characteristics such as Prior Knowledge (PK), Self-Regulated Learning (SRL) and Consistency of Interests (CI) play a significant antecedent role for the dependent factors (perceived usefulness and use) in the proposed model?

According to previous studies, technological elements are the main antecedents of the perceived usefulness and use of e-learning systems (Davis, 1989). However, the characteristics of individuals as antecedents of perceived usefulness and use require further investigation.

The second study will allow us to answer the questions:

- What business strategies should be considered to ensure the pedagogical, technological, human and financial success of e-learning systems?

- How to integrate the Business Model Canvas (BMC) and Technology Roadmap (TRM) tools to provide a sustainable business model aligned with current and future business needs?

Based on previous studies, an institution's readiness to adopt e-learning as an education system is measured in terms of technical, content, human and financial resources.

2.5. Research objectives and significance

2.5.1. Research objectives

Many Gabonese authorities see the development of ICT and e-learning systems as an effective and sustainable solution to the many problems encountered in universities, including the low number of educational structures and overcrowded classrooms. The aim of my work is to provide the government with tools, as much as possible, that can help to effectively adopt and install an e-learning system, a system that will be perceived as useful by users and actually be used, but also a system that will generate profits.

Adopting e-learning technology as an educational system without planning can be costly in terms of time, money and energy (Rohayani et al., 2015). It is therefore important to study the determining factors for the success of e-learning. My first study aims to investigate the perception of online learning systems for students and teachers. Thus, the objectives of this study are (1) to select antecedent factors of perceived usefulness and use, (2) to test measurement models to investigate the ability of these factors to measure the success of learning systems, and (3) to test the structural model and examine the direct relationships between the factors.

Any organization that intends to successfully implement a sustainable e-learning system must employ an effective strategy to avoid setbacks and waste of resources. It is therefore important to study upstream the determining factors for effective and profitable e-learning systems. The purpose of my second study is to investigate the frameworks for creating a successful business model for e-learning systems. Thus the objectives are (1) to contribute to the research for the most efficient business models in the field of e-learning, (2) to generate a business model framework using the Business Model Canvas (BMC) and Technology Roadmap tools (TRM) and illustrate that framework on an e-learning case study, and (3) and combine these two management tools to create a sustainable business model for effective implementation of e-learning in higher education in Gabon.

2.5.2. Research significance

Enhancing the performance and achievement of students and teachers by providing an effective e-learning system will encourage them to perceive and use it as a powerful educational tool just as the traditional classroom teaching. This study examines the role of technological factors (System quality, Information quality, and Service quality) and individual factors (Prior knowledge, Self-regulated learning, and Consistency of interests) in improving perceived usefulness and use for the effectiveness of e-learning systems.

First, the literature review reveals that individuals' factors have rarely been used as determinant constructs of perceived usefulness and use in the field of research concerning the success of e-learning systems. The validity and reliability of these individual factors as determinants of perceived usefulness and use are tested in the context of our research. Based on the results, recommendations are made for educational institutions and governments to use these factors to support and improve the perception and use of e-learning systems.

Second, the work contributes to existing research on sustainable e-learning business models, by providing a framework generated by combining two strategic management tools; Business Model Canvas and Technology Road Map. Previous studies have suggested paying more attention to the importance of leadership and coordination in implementation processes (Stoffregen et al., 2015).

Therefore, I need to examine the ability of public or private educational institutions to provide quality online learning systems over the long term. To enrich the literature on the success factors of e-learning systems, this work examines the business strategies that can allow institutions to create the best possible value in terms of e-learning, but also to generate revenues that will maintain this system, and offer a high level of service quality over the long term. Based on the findings, recommendations are made to educational institutions, managers, and governments on creating and maintaining high-quality online learning systems.

CHAPTER III: Literature Review & Research Background

3.1. Traditional learning

Traditional learning refers to the basic learning process of conventional education that takes place physically in a classroom. Teachers and students meet physically and teach and learn face to face. Learning materials are provided physically and students receive live feedback. In addition, the teacher can supervise and assist the work of the students. Even if today the trend is to use more and more ICT in university and school education, the fact remains that traditional (face-to-face) learning in the classroom remains important or even predominant. Baloian, Pino and Hoppe (2000) state that traditional face-to-face learning has the advantage of being familiar, close and comfortable for instructors and students.

Often, traditional education primarily practices teacher-centered learning. Traditional education emphasizes direct instruction and learning for students. Students learn primarily by listening and observing in a physical learning environment. However, they have the opportunity to discuss the details of the work and clear up their doubts. This will help improve student performance and skills more effectively. With the new educational reforms, student-centered learning is also encouraged in physical learning environments.

The key difference between online education and traditional education is that online education takes place in a virtual environment while traditional education takes place in a physical classroom environment (Table 3.1).

Even though face-to-face teaching environments encourage passive student learning, its main disadvantages are ignoring individual differences and learner needs, and failing to pay attention to problem solving or critical thinking (Banathy, 1994; Hannum and Briggs, 1982). Distance learning, online learning and e-learning are different modes of learning that could be incorporated into the concept of traditional learning.

With the development of the World Wide Web and the increasing use of ICT, we can see a shift from traditional classroom teaching (lectures, discussions, exams and assignments) to blended/hybrid teaching (sharing learning activities between classrooms and e-learning systems); many institutions go even further by offering 100% online teaching (self-directed learning, collaborative learning and forums).

Traditional study models enable face-to-face and personalized interaction with student/instructor support, the ability for the instructor to find out more about their students, etc. This shift from traditional learning to online learning has brought about other factors as students enrolled in online education are unique individuals, coming from different countries, having different incentives, etc. (DeBoer et al.,

2013). E-learning has become mainstream and is described as the use of an electronic information system to confirm and create knowledge. The objective of e-learning is to constitute a community independent of time and place thanks to information and communication technologies. This has become a challenge for many developing countries. It is a revolution rather than a replacement in education (Alkhateeb, AlMaghayreh, Aljawarneh, Muhsin, & Nsour, 2010; Kwofie & Henten, 2011).

Table 3.1: Differences between online and traditional learning

Online education	Traditional education
It happens online	It happens offline
Anytime, anyplace	Forced in a schedule and place
Flexible pace	Imposed pace
Alone	Together with your colleagues
Supports an independent learning style	Learning from and with each other
The primary source of information is online content	The primary source of information is the trainer
Limited interaction	Extensive interaction between trainers and colleagues
Student-centered learning	Teacher-centered learning

3.2. Introduction to e-learning

3.2.1 History and definition of e-learning

The origin of e-learning is not unanimous among researchers (Harasim, 2000). Therefore, there is no standard definition of e-learning and there is no approved theory of e-learning evolution. Since the 1960s, educators and trainers at all levels of education, business, training, and the military have used technology and computers in a variety of ways to support and improve teaching and learning (Nicholson, 2007).

According to Campbell (2004), e-learning is not used everywhere in the same way. In the school sector, e-learning refers to the use of both software and e-learning, while in the business, higher

education, military and of training, it primarily refers to the flexible delivery of Internet-based content and programs that focus on maintaining particular communities of practice.

Patrick Suppes and Don Bitzer are two major players who laid the foundations of e-learning systems. Suppes (1966) argued that: "In the future, it would be possible for all students to have access to the service of a personal tutor in the same way as former members of the royal family were once served by individual tutors, but this time the tutors would be in the form of a computer.

In the early 1960s, Don Bitzer at the University of Illinois created a time-sharing computer system called PLATO (Programmed Logic for Automatic Teaching Operations) that allowed students and teachers to use graphics terminals and TUTOR, an educational programming language that allowed to communicate and interact with other users by means of electronic notes, which is the precursor of current conferencing systems (Bitzer et al., 1962).

Just like the concept of business model, there are many definitions of e-learning, and depending on the specificity of each sector, it can take one direction or another. I can define e-learning as teaching and learning using electronic media like the Internet to access the educational program remotely, without the need for a traditional classroom. For Guri-Rosenblit (2006), e-learning covers the integration of Information and Communication Technologies (ICT) in educational environments. Institutions adopting e-learning strategies are increasingly numerous in developing countries. However, the success of the use of ICT in education will be guaranteed not only by the provision of technologies, but also by the support and assistance to users (students, teachers and academic staff) in their attempt to integrate this new way to learn. Online learning is gradually becoming a standard feature in many schools, partially or totally replacing classroom lessons with online lessons.

In summary, I can see that e-learning is technology-based learning that involves different technological components such as Email, CD-ROM, TV, Internet, mobile devices (laptops, mobiles and tablets), etc. to facilitate and enhance the learning exchange between instructors and students (Ali S., 2017).

3.2.2 Benefits of e-learning

The broad movement towards online learning is clearly driven by the many benefits it offers. Online learning helps individuals overcome most of the barriers they face in traditional ways of learning and provides an easy way to learn. However, the time when computers will completely replace human instructors and other forms of teaching delivery has not yet come. The main benefits of online learning

are low cost, flexibility, convenience, and the ability to study at your own pace anytime, anywhere with an internet connection.

Cost is a very important factor in evaluating whether a new technology is appropriate or not (Bartley & Golek, 2004). E-learning is considered cost-effective as it can be delivered to a large number of students at the same time without any increase in personal cost and achieved favorable results. There are also more time savings to be gained than going to a classroom. Cisco Systems achieves 40-60% savings from e-learning compared to instructor-led training, and more than 80% of Cisco technical employees currently participate in e-learning (Gill, 2000).

Among other advantages, I can talk about convenience and flexibility. Classes are available 24/7 and do not require physical attendance as long as the necessary equipment is accessible. Users are not bound by time and place. They can learn at home, at work or on the road at their own pace. This way of learning reduces stress and increases satisfaction for both slow and fast learners. Access to quality education and better retention is an important benefit. The fact that instructors of the highest caliber can share their knowledge across borders allows learners to take courses across physical, political and social boundaries. In addition, e-learning helps increase access to better higher education where educational facilities are few and crowded.

Online education enables workers to pursue higher education (Kwofie & Henten, 2011). After secondary education, people seek more educational opportunities that match their professional life, but traditional learning cannot afford it, due to limited time, strict working hours and cost. Within these constraints, e-learning is a good solution for further human development. Hall (1997) found that online learning reduces learning time compared to classroom learning. This author stated, “there is very strong evidence that computer-based training requires less time for training compared to instructor-led training. The amount of the discount ranges from 20-80%, with 40-60% being the most common". E-learning media serve as a means of transport for the dissemination of knowledge and reduce the cost of travel for students from rural areas to developed capitals to benefit from education (Kaur, 2013). Technological tools also facilitate collaboration between users. Since many projects involve collaborative learning, the online environment is much easier (and often more comfortable) to work in since learners don't need to be face-to-face.

In short, e-learning is considered a low-cost, high-access alternative to traditional education. However, despite all these advantages of e-learning, it is not always successful for every university or country.

3.2.3 E-Learning modes of delivery: asynchronous mode, synchronous mode, blended learning, MOOC

Thanks to learning management systems, there are mainly four online learning delivery methods that are: asynchronous, synchronous, blended and MOOC. These learning management systems facilitate the download and sharing of courses, the download and examination of student assignments, participation in online discussions and the production of surveys, among others (Rice, 2011).

Asynchronous (also called Self Study Learning) consists of content available online at any time when the student wishes to access it (Singh, 2003). Communication, collaboration and learning can occur in different times and different places; Learning does not require the simultaneous participation of learners and instructors; people can learn at anytime and anywhere, even when participants are not online. This "delivery of learning on demand" gives learners more control over the learning process and content (Zhang and Nunamaker, 2003). However, a big drawback is that learners feel isolated and sometimes frustrated due to the lack of intimate support and feedback from teachers and other students (Gisondi, et al., 2010).

Synchronous mode is different from asynchronous mode because it involves videoconferencing and interactive interaction in real time. Synchronous learning requires the presence of both parties at the same time for learning to take place. Therefore, it is also called live or real-time interaction (Harriman, 2005). This form of e-learning is advantageous for students who need immediate feedback and live online interaction thanks to the use of tools such as videoconferencing, chat rooms, white boards and the audio conference (Clark and Mayer, 2003).

Since that traditional teaching in class has become obsolete on the one hand, and education entirely online can be a bit complicated and expensive for many schools and their students on the other hand, many organizations combine these two modes of learning to deliver and offer what is called blended learning. Blended learning (also called hybrid learning) is the mixture and integration of different learning delivery approaches, including classroom and online learning to create a single learning program, where the instructor combines online distance learning elements with traditional face to face learning. It can also be a mixture of various event-based activities such as face to face classrooms, self-paced learning (asynchronous), and synchronous (Smith, 2001).

MOOC stands for Massive Open Online Courses. These are free online courses available to everyone. MOOCs provide an affordable and flexible way to learn new skills, advance your career, and deliver quality educational experiences at scale. For example, Coursera, one of the world's leading MOOC providers, has partnered with the University of Illinois to offer online MBA programs.

MOOCs are a stereotype of open and distance education that is characterized by open technology, open software, open content, open educational resources, open knowledge sharing, open access, open communication, and curriculum open (Kennedy, 2014; Gaebel, 2013). Open also means it is free except for students who may need credit certification (Gaebel, 2013). MOOCs are also representative of their massive nature which attracts an unlimited number of students per course enrollment (Kennedy, 2014).

3.3. Case studies of e-learning

Due to all the benefits I can derive from implementing e-learning systems, e-learning has today become popular in many higher education institutions around the world (Sharpe et al ., 2006), although it should be noted that not all are successful. Many implementations encounter significant issues during adoption.

The National University of Singapore has used an online learning system called IVLE (Integrated Virtual Learning Environment) to teach over 9,000 graduate students and 23,500 undergraduate students in multidisciplinary courses. The IVLE system contributed positively to the increase in human capital, productivity and workforce skills (Bashar & Khan, 2007). In Iran, Motaghian et al. (2013) measured the adoption of e-learning systems by collecting data from 115 universities. The results showed that there is a rise in the acceptance of the e-learning system among the teachers (Motaghian, Hassanzadeh and Moghadam, 2013).

Another study conducted by Office Depot, a virtual classroom was used to simultaneously train students in Florida, California and Texas. This led to a three-fold increase in enrollment, while increasing satisfaction students by 30%, knowledge retention by 25% and decreasing at the same time costs by 80% (Horton, 2011).

Universities in developing countries, particularly in sub-Saharan Africa, are gradually adopting e-learning technologies for teaching, research and supporting student learning to reap the same benefits as those harnessed by developed economies (Aguti, Walters, & Wills, 2014). The M-learning system (e-learning Mathematics system) has been rolled out at the University of Namibia and Rhodes, with 800 students registering to use the system, despite a low number of faculties. Interestingly, the program's failure rate was low, which prompted the development of a blended solution, the m-Learning System Enhancing Mathematical Concepts (m-LSEMC). This resulted in better administration and better fainting rates (Ntinda, Thinyane, & Sieborger, 2014).

In the second study of this research, I illustrate a case study, SCIENTIA, a platform that allows the management and monitoring of all the school life in middle school and high school in Gabon (courses, transcripts, attendance, exams, homework, map report, parental supervision, etc.). This e-learning system has helped to reduce student failure rates and increase parents' control over their children's academic performance.

3.4. E-learning systems implementation challenges

To be most effective, e-learning must be integrated into the daily tasks of students and employees (academics and managers), and not be seen as a separate tool for learning and training. The advent of this new method of learning is not without difficulties and challenges, especially for developing countries. Previous studies have revealed challenges regarding coursework, for example. Since e-learning is different from traditional classroom teaching, there is a need to develop new programs based on e-learning parameters (Annika and Å ke, 2009). Additionally, the need to change the pedagogical model from an instructor-centered approach to a more student-centered approach should also be considered. Another concern that has proven to be effective is flexibility or the ability for students to learn at their own pace and take exams whenever they want (Li & Irby, 2008).

Other challenges relate to the characteristics of individuals such as motivation. Highly motivated students are expected to perform well in most cases compared to unmotivated students. Financial difficulties must also be taken into account. According to Li and Irby (2008), academic trust (a student's academic experience and qualifications) is found to be an important factor in distinguishing successful online students from unsuccessful ones.

The technical and technological challenges are not left out. First, access to ICTs and their availability. Access refers not only to whether a learner has physical access to a computer, laptop or mobile device, but also to a reliable internet connection and the bandwidth needed to access all necessary content. Baldwin-Evans (2004) and Mungania (2003) also studied barriers to implementing e-learning systems. These studies found that technical challenges include building and upgrading infrastructure, maintaining connectivity and bandwidth, as prolonged downloading of course materials can lead to loss of interest in the course, and accessibility and usability where limited access to course materials and learning websites will affect learning. Technical barriers also encompass the lack of technical support, where learners sometimes find it difficult to enroll in online courses or master a new set of skills (using online tools, communicating effectively) and managing specific procedures such as passwords and permissions.

The cost of these technologies is also an important factor. One can also mention some contextual factors such as attitudes towards computing and online learning, positive or negative attitudes or whether people perceive online learning as less effective than face-to-face teaching (Gammill et al., 2005), with teachers and students themselves perceiving online learning as inferior to traditional courses.

3.5. E-learning systems success factors

3.5.1 Perceived usefulness

Alsabawy et al. (2016) stated that perceived usefulness is the primary metric for assessing the acceptance and success of e-learning systems. According to Davis (1989), perceived usefulness is the degree to which a person believes that using a particular system would improve their job performance. Additionally, Davis, Bagozzi, and Warshaw (1989) confirmed the reliability and validity of perceived usefulness as a predictor of intention to use information technology.

In the field of e-learning systems, the study by Teo (2011) found that course delivery, tutor attributes and facilitating conditions were the main factors affecting perceived usefulness. Mohammadi (2015) also found that ease of use was the main determinant of perceived usefulness, consistent with the Technology Acceptance Model (TAM). The results of several studies have confirmed the validity of the concept of perceived usefulness for evaluating the success of e-learning systems.

3.5.2. Learning behavioral types and e-learning effectiveness

E-learning is a learning method that can be seen as a solution or at least an enhancement to traditional classroom learning. With e-learning, students can access courses anytime, from anywhere and can complete their educational programs at their own pace. This flexibility of online learning, seen by many as an advantage, is also seen by others as a weakness for students who are unable to complete their assignment on time.

Much research has shown the negative effects of procrastination on learning performance and others have argued that self-regulated learning is important for improving student learning effectiveness (Gordon, Dembo, & Hocevar, 2007; Law, Chan, & Sachs, 2008; Wang, 2011). For R. Garcia et al. (2018, p.150) “Self-Regulated Learning (SRL) is the active control students take over their learning to ensure they achieve their learning goals”. According to (Zimmerman, 1989), self-regulated learners are those

who plan, set goals, organize, self-monitor and self-evaluate their educational programs. This meaning can also be applied to teachers in their lesson creation process.

E-learning systems have a double benefit: technologies allow students to learn and acquire knowledge at their own pace, but also allow teachers more time to create more online courses, virtual seminars and hands-on training. Thus, skills like planning and time management would help them to be autonomous in achieving their goals (Kizilcec & Halawa, 2015). For Kizilcec and his colleague metacognitive strategies such as "goal setting, strategic planning, self-assessment, task strategy, elaboration, and help-seeking" can help students support their learning in massive open online courses (MOOC).

According to Hu and Gramling (2008), self-regulated learning strategies are needed to improve learners' motivation and understanding in the online learning process. Motivation has a vital role to play in learning activities and can have a significant impact on learner achievement (Stipek, 1993).

3.5.3. Prior knowledge and e-learning effectiveness

Many researchers have found that prior knowledge generally facilitates learning, but inaccurate or incomplete prior knowledge can restrict learning (Hailikari, Nevgi, & Lindblom-Ylänne, 2007; Kalyuga, 2008). Prior knowledge is also a determining factor related to the effectiveness of online learning. Mitchell et al. (2005) argued that learners with different levels of prior knowledge did not have the same attitudes towards features of online learning content, which in turn affected their online learning outcomes (Mitchell, Chen and Macredie, 2005; Wang, 2010). It will be difficult for learners with a low level of prior knowledge to learn new materials or concepts, and they will need more guidance and support. I argue that a student who has been exposed to computers and internet during his secondary education will find it easier to use online learning systems once at university compared to a student who hasn't had the chance to use computers and internet when he or she was in high school.

3.5.4. Grit concept and e-learning

The Grit concept was introduced by Duckworth et al. who defined it as "perseverance and passion for long-term goals". According to them, "courage involves working hard to overcome challenges, maintaining effort and interest over the years despite failure, adversity and ongoing plateaus" (Duckworth et al., 2007, p.1087). In the field of education, research has shown that Grit is a reliable predictor of better learning outcomes.

Learning in higher education is a long-term process and students can only achieve significant results after investing a lot of time and effort. Individuals are different, so they cannot continue to care and work hard over a long period of time in the same way. Some students may try again and again after many failures where others will give up. Successful students fail more than once, but persevere to achieve their goals.

Grit has been studied in the fields of psychology and health, but some authors like Duckworth & Quinn (2009) and Ivcevic & Brackett (2014) have suggested the need to explore the effects of grit in other fields. Thus, Aparicio et al. (2016) conducted a study on the effects of Grit in the success of e-learning systems, investigating the impact of Grit on Use and on Learner's Satisfaction, in association with DeLone and McLean (1992) information systems' success model. This study showed that the effect of Grit on the use and satisfaction of learners was partially confirmed, and that the understanding and evaluation of the non-cognitive characteristics of e-learners is a determining factor for success.

3.6. Business models and business model canvas (BMC)

3.6.1. Business models

Given all these challenges faced when setting up e-learning systems, public and private educational institutions must adopt efficient and sustainable business models that allow them to create value for their targeted audience, deliver this value in the most efficient way possible, seek effective partners who would help them produce this value at the lowest cost and increase their cash flow. For Seppanen & Makinen (2007), there are several definitions of business models. Bieger & Reinhold (2011) explain this multiplicity of definitions by the fact that each domain tries to define the concept from its own point of view. Osterwalder (2005) agrees that the term "business model" never really had a clear meaning. For this author, the business model can be seen as an abstract representation of the "business" logic of an organization and represents a master plan of how a company does business.

For my contribution to the definition of this concept, I can say that the business model of a company is a strategic management tool that helps to clearly define the vision of the company, the value offered by the company to a specific target market, the processes and tools used to create and deliver that value, and the costs and revenue streams generated by the value creation. A strategic, efficient and sustainable business model will help a company achieve a significant return on investment.

Not far from my definition, Osterwalder and Pigneur (2010) define a business model as the logic of a company to develop, distribute and obtain value. Business models and customers are necessary and

useful to achieve more interests and more satisfaction with the business. Blaschke et al. (2017) have also worked on the concept, and for them an effective business model must capture the key aspects of the company's activity by answering four questions: “what value propositions are offered?”, “who are the clients?”, “how should operations work?”, and “why is the business model financially attractive?”. Some authors also draw attention to the importance of the competitive market environment in establishing business models, necessary to create and realize value for stakeholders (Casadesus-Masanell & Ricart, 2010).

3.6.2. The Business Model Canvas (BMC)

Most of the time, business people only focus on the product or technological innovation but pay little or no attention to the "business" aspect of the project, i.e. who will use the product, how to communicate, how to deliver and especially how to earn money with this project.

The Business Model Canvas (BMC) is a business visualization and modeling tool, developed by Osterwalder, Pigneur and Smith (2010). This tool is used to explain the business strategy of the company and the relationship between the components of the model (Kosasi, 2015). Due to its simplicity, the BMC is very popular within the business community. It helps understand even the most complex businesses by breaking down their strategy into a single and simple visual overview. It helps the business identify the best value proposition for a specific group of people called the target market or ideal customers. It also helps establish the most effective way to communicate and distribute the products and services provided to consumers (Hartatik & Baroto, 2017); it shows how to create and execute the key activities and key resources needed to create the value proposition; it establishes the costs and revenues of the business. However, there is no need to dig and get lost in so many details.

Even if the BMC is a very flexible concept and hyper specific to each company, the basic framework is always broken down into these 9 key elements with a conceptual order of priority (Osterwalder, Pigneur and Smith, 2010); see Figure 3.1.

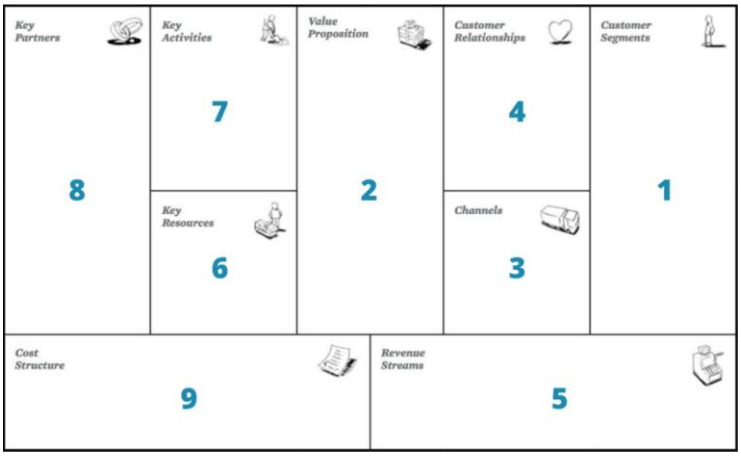


Figure 3.1: The Business Model Canvas (BMC). Osterwalder, Pigneur and Smith (2009)

The BMC therefore mainly focuses on four major strategic business areas as shown in Table 3.2

Table 3.2: Elements of the Business Model Canvas (BMC) (Osterwalder & Pigneur, 2009).

Business Areas	Key elements	Description
Customers (Who?)	Customer segments (1)	Who is your target customer? Knowing in depth your customer's needs and expectations could help a lot in creating a product or service that'll fit their real expectations.
	Channels (3)	The company uses the most efficient communication, distribution and sales channels to make the product or service available and accessible to the target customer.
	Customer relationships (4)	Once the contact is established, the company should maintain the relationship in each customer segment according to their needs.
Offering (What?)	Value proposition (2)	After collecting the customers' needs, the company creates a valuable product or service with the benefits for one or many customer segments in mind to satisfy their needs.
Infrastructure (How?)	Key Resources (6)	At this level, managers talk about the resources needed (human, technological and of course financial) to create a product or service that will meet customer expectations.
	Key Activities (7)	At this level, managers must bring out some key activities and processes that are necessary for value creation from senior management to the bottom of the ladder.
	Key Partnerships (8)	In today's sharing economy, companies, for reasons of efficiency, prefer to focus on their key activities and outsource extra activities to their key partners in the value creation.
Financials	Revenue streams (5)	The company determines the different income or revenue streams generated by each customer segment.
	Cost structure (9)	The company must take into account the costs structure (fixed and variable costs) or what are the costs to make the business model work.

3.7. Technology Roadmap (TRM)

While BMC is more about the current and internal situation of the business, the Technology Roadmap (TRM) is more about the future and external environment of the business. A technology roadmap (TRM) is a high-level visual plan that communicates an organization's long-term technology strategy, providing structured relationships between evolving and developing markets, products, and technologies over time (Phaal et al., 2004a). Companies use TRM to plan and manage internal IT projects (major initiatives and schedule of work that will be delivered), TRM being more of the "why" of the IT project, the "what" being the actual functionality or performance and the "when" the execution plan. A successful TRM helps strike a balance between market pull (providing products demanded by the market) and technology push (interesting the market in new products); see Figure 3.2.

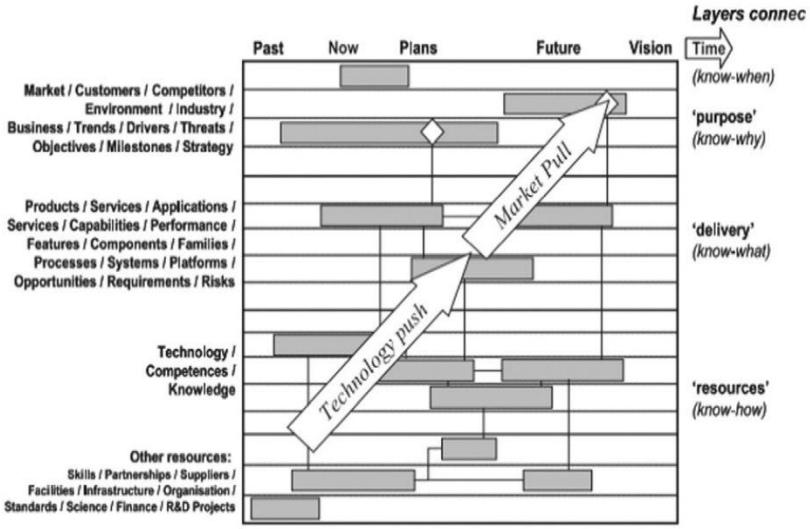


Figure 3.2: Generalized technology roadmap architecture (Phaal et al., 2004b).

TRM helps support strategy and development of cutting-edge technologies by making key connections between technology resources and business drivers, identifying critical gaps in market, product and technology intelligence, and planning corporate initiatives to support communication between technical, marketing and other business functions. According to Phaal et al. (2004a), some important factors contribute to a successful and sustainable roadmap initiative: a clear business need, tangible benefits, and appropriate timing for each activity; good architecture that reflects the structure of the organization; strong senior management commitment and support; and an effective process manager

who gathers relevant information using cross-functional/multidisciplinary people with the required expertise to develop a well-founded and credible roadmap.

3.7.1. Types of roadmaps

Of the eight (8) types of graphical roadmaps for strategic management identified by Phaal et al. (2004b), for the purposes of this study, I have chosen the type of multiple layers, which is the most commonly used layout to analyze current and future situations related to three main levels defined by Cosner et al. (2007): market, product and technology (see Figure 3.3).

The *Market level* describes current and future customer needs as well as competitive strategies, regulatory environment, substitute products, disruptive innovations and many other factors. Strategic goals and market targets are often defined as milestones or target dates for certain events. The *Product level* relates to the development of product performance and functionality, new-to-the-company or new-to-the-world products, and the *Technology level* describes the expected R&D products, their availability dates, the determinants and the associated information.

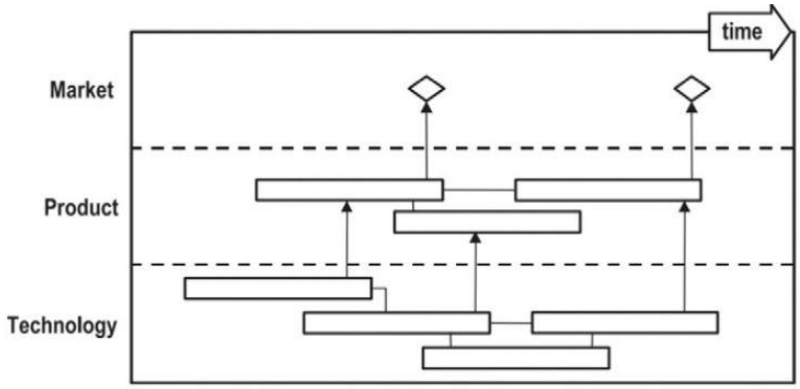


Figure 3.3: A multilayer TRM: market, product and technology analysis (Phaal et al., 2004b)

3.7.2. Methods to construct a roadmap

Previous studies have defined three main approaches in building the roadmap, depending on the organization of the participants: the *central process* (the management team builds the roadmap from the information provided by the business units), the *workshop approach* (roadmaps are built in collaborative sessions with business unit content owners) and the *distributed approach* (roadmaps are built by

individual business units, then integrated based on guidelines provided by the management team). In this study, I will use the workshop approach because the method promotes team interaction, improves communication and ownership of plans in the construction process (Cosner et al., 2007; de Reuver, Bouwman and Haaker, 2013).

A successful TRM must match the profile of the business and the outlook for future scenarios. This is why, in this study, I will use two practical and effective tools, the T-plane and the connecting grid, to build a technological roadmap. Developed by Phaal, Farrukh and Probert (2004b) to create a TRM in an organization, the T-plan consists of the application of four workshops; one for each level of the TRM and one more to link them all in a timeline (see Figure 3.4).

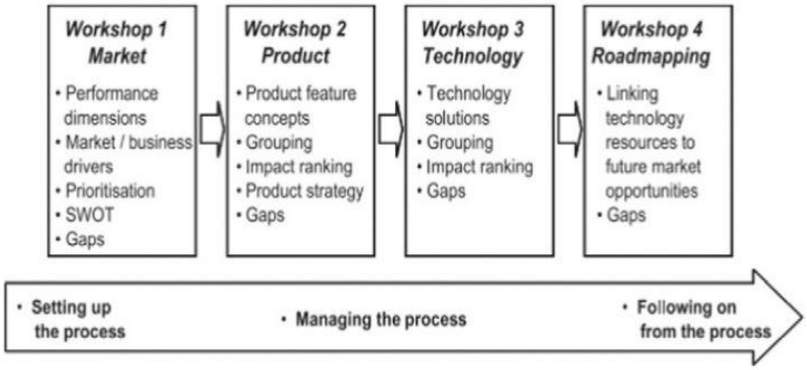


Figure 3.4: T-plan: standard process (Phaal et al., 2004a).

Since the building blocks of a TRM are the layers, it is recommended to develop their relationship from the beginning. According to Phaal, Farrukh and Probert (2006) for each market driver could have one or more product features, and for each product feature could have one or more technological solutions. The connecting grid is made to connect the levels in the TRM (Figure 3.5).

In order to link the levels and direct the company's efforts towards market pull, the T-plan uses the linking grid tool, although the technological push is also considered as its objective is to generate new technological solutions.

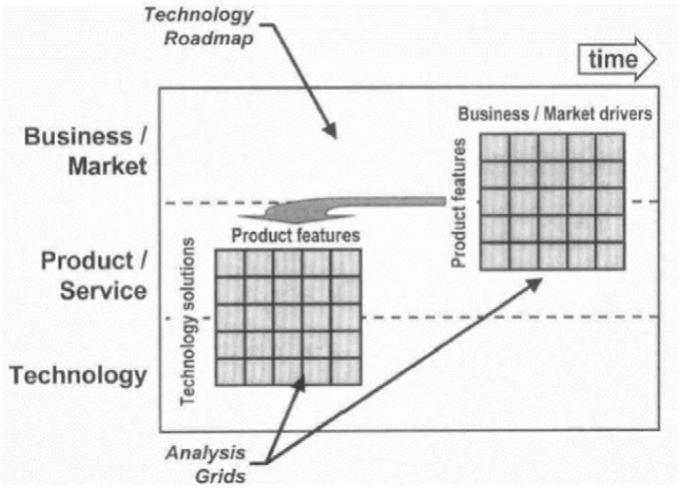


Figure 3.5: Schematic of a linking grid analysis (Phaal R. et al., 2003)

3.8. Previous BM–TRM integration works

BM and TRM are two strategic and powerful management tools used by small and large companies. However, when used independently and separately, it is difficult to get the most out of them, compared to when used together. As mentioned before, BM (or BMC) is more about the internal environment of the company; but to be more effective, the company must take into account and adapt to its external environment which is described by the TRM. To generate a new, more powerful tool to explore a company's present and future, many strategic management practitioners and researchers have combined BM and TRM to achieve a more robust strategy (Pillkahn, 2008). Phaal, Farrukh and Probert (2004b) argue that it is important that technology strategy is not developed independently of business strategy, but rather that technology resources are considered an integral part of a business plan.

In order to integrate BM and TRM, many authors such as Osterwalder & Pigneur (2010) and Abe, Ashiki, Suzuki, Jinno, & Sakuma (2009) have used Porter's five forces: 1) threat of new entrants, 2) threat of substitute products or services, 3) bargaining power of suppliers, 4) bargaining power of customers, and 5) rivalry among existing competitors. According to Porter (2008), “managers define competition too narrowly, as if it only occurs between today's direct competitors. The extended rivalry that results from the five forces defines the structure of an industry and shapes the nature of competitive interaction within an industry”.

In a study named "Smart-Innovation Planning Method", Abe, Shinokura, Suzuki, Kubo and Sakuma (2006) used BM output as input for Strategic Road Map (SRM) and the methodology consisted of 5 steps: 1) combination of business ideas and database, 2a) value chain analysis, macro environment, PEST and business environment, 2b) scenario forecasting, 3a) scenario planning, 3b) make an exploratory roadmap using the baseline scenarios, 4a) integration of output from step 3b and SRM, 4b) confirmation of target customer, product, method of supply and profit model; and 5) factor-based decision making.

"Innovation Support Technology" is a new corporate strategic planning method developed by Abe, Ashiki, Suzuki, Jinno and Sakuma (2009) for the integration of BM and Strategic Roadmapping (SRM). The applied methodology uses three steps:

a) The product concept and business idea based on the R&D results are described. The objective of this step is to generate the technological scenario.

b) Business scenario planning, enabling the technology to achieve the business goal in the future.

c) The content of the company's technology roadmap and the results of these roadmap workshops are reflected in the business model.

Abe, Ashiki, Suzuki, Jinno and Sakuma (2009) analyzed BM and SRM and summarized the advantages and disadvantages of the two tools (see Table 3.3).

Table 3.3: Pros and cons of BM and SRM (Hitoshi Abe et al., 2009).

Pros	**Cons**
Business model	
1. To know how to create company value from R&D outputs and provide an operation model; 2. Modeling tool to create business concept from business idea 3. Help the modeling of competitive strategy technology. How? What? And to whom? 4. Provide the service/product and how to win competition	1. Difficult to find out market trends and opportunities 2. Difficult to make a decision of invest timing 3. Difficult to judge the choice of an alternative technology 4. Difficult to know when? And what? technology should be developed
Strategic roadmap	
1. Roadmaps consist of layers, such as market, business, products, technology and resources. They are systematically expressed on a time-axis of R&D outputs; 2. It can be utilized as a strategy planning tool, which supports, helps to explore opportunities, permits the choice of alternative technologies, and associates the elements between layers; 3. Knowledge creation for a better action: discovery of gaps, bottlenecks, technological defections, promotion of development and estimate the required resources.	1. Difficult to express a business attractiveness of R&D outputs 2. Difficult to express a business system or operation model 3. It takes more time to create and maintain roadmap under satisfying comprehensiveness 4. Difficult to evaluate business value

CHAPTER IV Research Methodology

4.1. Introduction

The general objective of my work is to shed more light on the effectiveness of the implementation of e-learning systems. The previous chapter focused on literature review related to the implementation of e-learning systems (history, case studies and barriers to implementation and success factors) and business management (business model, Business Model Canvas and Technology Roadmap). The result of this literature review led to the development of the model proposed in my first study and the case study in the second. This third chapter deals with the research methodology. Yin (2008) argues that a research methodology defines action plans from the research questions (the starting point of the research) to the answers which constitute a set of conclusions. For Hennink et al. (2010) and Myers (2013) there are different research approaches, thus certain types of research require particular approaches and certain approaches are more suited to certain types of research than to others.

In this chapter, I will choose, explain and justify the appropriate research paradigms, approaches, strategies and methods used to answer the research questions, both in Study 1 and Study 2. After clarifying the most appropriate research methodology that meets the objectives of this research, I will explain and justify the target population, the types of sampling and the sample frame and size. Next, the development of the instruments for each research question and ethical considerations are explained. Finally, the techniques and procedures that will be used for data collection and analysis in the following chapters are explained as well.

I will use the "Research Onion" concept proposed by Saunders et al. (2009) to justify each step of the research methodology for my research questions (see Figure 4.1). Items in bold are critically chosen for use in the current study.

4.2 General research approaches

The choice of research philosophy is crucial to validate the study strategy. The research philosophy I adopt will have a significant consequence on the problem I'm trying to study (Johnson & Clark, 2006). Research philosophies are the methods, practices, guidelines, and belief systems that are widely accepted and must be consistently followed by the researcher in order to conduct the study.

Many authors have developed different types of research philosophies in the literature (Cresswell, 2003). Saunders et al., (2009) research onion (Figure 4.1), and Easterby-Smith et al., (2012) have been credited with respectively explaining the three most widely used paradigms, namely "Positivism", "Interpretivism" and "Pragmatism". Orlikowski & Baroudi (1991) also noted these three philosophical approaches in their studies of Information Systems (IS). These techniques focus more on various study strategies, as well as examining the nature of knowledge.

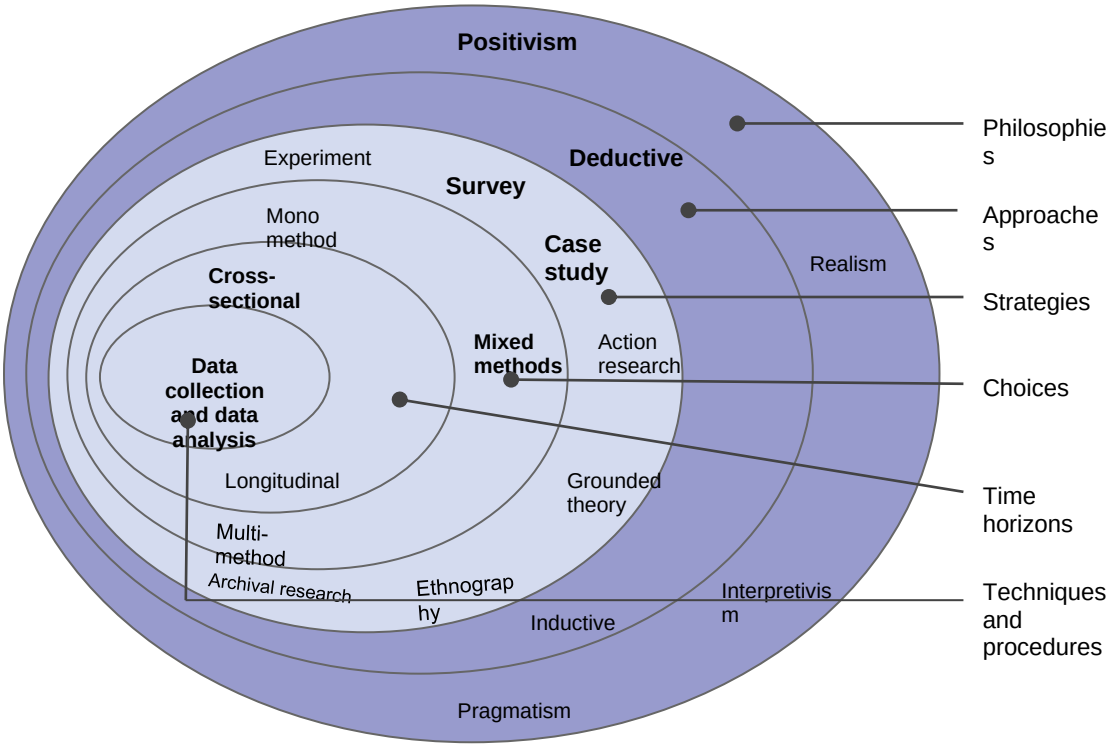


Figure 4.1: Research Onion (Saunders et al. 2009)

However, despite differing perspectives on these research paradigms, there are three underlying research philosophies explained by all authors, which are: "Ontology", "Epistemology" and "Methodology" (Meyer, 1990; Guba & Lincoln, 1994; Creswell, 2003). *Ontology* is related to the nature of reality (Saunders, Lewis and Thornhill, 2009). It is the "what" and the "how" of what we know - in other words, what is the nature of reality and what we are really capable of knowing and understanding. *Epistemology* is the researchers' view of reality and how it can be understood (Creswell, 2003; Cater-

Steel, 2008) and methodology is the process and technique of collecting and validating empirical evidence regarding the problem current, that is, how the research validates the solution to the problem.

Positivism is a philosophy based on measurable evidence, distinct from the observer. For example, researchers use the positivist approach when seeking to test hypotheses in an effort to better understand the topic at hand. Such a strategy argues that the phenomenon is present beyond the human mind, as noted by Orlikowski & Baroudi (1991) and Bryman & Bell (2007). According to Creswell (2009) positivism offers a quantifiable and empirical solution to the postulates of the theory. Positivism also aims to explain the causal relationship of variables to develop a theory (TAM for example). Moreover, as established by previous Information Systems (IS) research, the positivist approach has been recognized as the key epistemology in the context of IS studies, as noted by various scholars in the field (Galliers et al., 2011; Straub et al., 2004; Walsham, 1995; Yin, 2011).

On the other hand, when examining a phenomenon from the point of view of those directly involved, an interpretivist approach is used (Irani et al., 1999; Straub et al., 2004). This research philosophy defines frameworks centered on access to the meaning of the subjects in an attempt to apprehend the phenomena examined (Orlikowski & Baroudi, 1991). Such an approach supports the idea that the beliefs and intentions of researchers cannot be ignored. Accordingly, interpretivism is recognized as knowledge that can be acquired through personal life experiences (Howe, 1988; Weber, 2004). Interpretivism emphasizes the influence that social and cultural factors can have on an individual. This view focuses on people's thoughts and ideas, in light of the socio-cultural context. Unlike positivism, where the researcher concludes results based on numbers, interpretivism focuses on the underlying causes of actions.

The paradigm research approach was developed in the early 20th century. For Tashakkori and Teddlie (2010), pragmatism demystifies concepts such as 'truth' and 'reality' and instead focuses on 'what works' as the truth regarding the research question under consideration. This concept is different from positivism and interpretivism because it states that in order to determine the correct ontology, epistemology and methodology, one must focus on the research question. Saunders, Lewis and Thornhill (2009) noted that the mixed method (quantitative and qualitative) is appropriate in this paradigm.

4.2.1 The choice of the Positivism and Interpretivism approaches

As I said earlier, the selection of an appropriate research philosophy is highly dependent on the research objectives. So now the question is “which research philosophy is best for my study?”.

For the research questions of Study 1, factors that affect *perceived usefulness* and *use* would be used to verify student and teacher perceptions of e-learning systems for successful adoption. Technological factors as well as individual factors will be used as antecedents of *perceived usefulness* and *use*, two important concepts for evaluating the success of e-learning systems. Answering these research questions will require the collection of numerical values through structured questionnaires, prior to statistical calculation.

For Study 2 research questions, I will explore the business factors (business models) that lead to the success of e-learning systems. This would be done using case studies from already world famous and successful e-learning platforms. Unlike before, this would not necessarily require quantitative values but rather qualitative values through case studies and interviews.

As I said earlier, positivism is a research paradigm that aims to find solutions to the research problem using quantifiable measures. Orlikowski & Baroudi (1991) define "Positivist research" as a study that uses numerical variables and involves outcomes and relationships between variables by collecting data from population respondents. I already know that in my work, to answer our research questions, I will use survey instruments to collect quantifiable measurements, and then process and interpret the collected data. SPSS and AMOS are the two statistics softwares I will use for data analysis. Moreover, according to Mingers (2003), positivism uses survey and questionnaire methods to collect responses and statistical software is used to draw conclusions from the collected data, and also positivism is present in more than 75% of studies in the field of Information Systems (IS). Therefore, Positivism will be applied to answer questions of my Study 1.

According to Creswell (2009), the theory developed and the concepts applied by the philosophy of interpretivism are mainly based on the understanding of the researcher. Unlike the concepts of positivism where the researcher concludes results based on numerical measurements, interpretivism gathers qualitative data and focuses on the underlying causes of actions through interviews or study cases. Therefore, the paradigm of interpretivism will be applied to answer questions of our Study 2.

4.2.2 Deductive approach Vs. Inductive approach

According to Saunders et al. (2009), only two approaches (the inductive approach and the deductive approach) can be followed in a research project. Inductive technique is a group of approaches that focus on implementing rigorously testable theories in the real world with the aim of examining their validity, while deductive reasoning focuses on confirming or testing hypotheses (Lancaster, 2007).

The deductive approach is considered a process by which researchers reach a reasoned conclusion using the logical generalization of a known fact. Such an approach is called "hypothetical deductive approach" because it involves many steps and is considered the basis of a scientific approach (Sekaran, 2006).

The first step in this process is the creation of hypotheses and theories, with the generation of ideas potentially based on theories and hypotheses derived from other studies or personal experiences (Alkharang, 2014). The second phase following the generation of the theories and hypotheses is the operationalization of the concepts in the hypotheses or theories where these concepts can be measured by empirical observations. The next step in the process involves establishing and deciding between alternative approaches or techniques to measure the operationalized concepts. Then, the last stage of the deductive process is the manufacture and rejection stage, which involves the researcher establishing the degree to which the selected hypotheses and theories are false, as well as the degree to which parts of those hypotheses and theories, if appropriate, have not yet been tampered with (Lancaster, 2005).

Different from deductive reasoning, inductive reasoning is a research approach where the bases of an argument are recognized as supporting the conclusion but do not assure it; that is, through inductive reasoning, researchers observe particular phenomena and, taking these into account, draw strong conclusions, then arriving at the logical identification of a general proposition based on the observed phenomena.

While the deductive approach starts from theories and goes towards empirical data, as my Study 1 does, the inductive approach, on the contrary, starts from empirical data and goes towards the theoretical literature to build a theory (my Study 2). Once the theory is formed, the researcher can again follow a deductive approach to validate or not the theory. Essentially, when comparing the inductive approach to the deductive approach, the former is more open-ended (Alkharang, 2014). Notably, the inductive approach has different steps that can be considered opposed to the deductive approach, moving from particular observations to broader theories and generalizations.

In the deductive approach, the goal is to confirm the hypothesis and verify the relationship between two or more variables. This involves looking at the specific outcome of the investigation, modifying the theory in light of the results and the causal relationship between the variables. The data is usually numerical in nature and collected through questionnaires (Saunders et al., 2009). Therefore, a deductive approach will be used in Study 1. While the inductive approach consists of grasping what is happening around and developing a theory based on observation. This approach is used in theory formulation and data is usually collected using interviews based on the collected data. In my Study 2, I conducted

interviews based on information collected from case studies in the literature. Therefore, an inductive approach will be used in Study 2.

4.2.3. Quantitative vs. Qualitative

Based on the deductive and inductive approaches, there are two methods to study research problems, namely quantitative and qualitative methodologies respectively. Quantitative and qualitative research methods were used to collect data from participants in Study 1 and Study 2.

For Bryman (2008), quantitative methods are called the solutions that seek to answer the research question through data and measurable relationships of variables. Denscombe (2010) states that to obtain quantitative data, quantitative research typically involves the use of questionnaires, structured interviews, observations, and document reviews. According to Bell (2005), quantitative research involves the gathering of facts and the study of relationships between sets of facts using research techniques that most likely produce quantified and, if possible, generalizable conclusions. Online questionnaires were used in Study 1 for the field study. Moreover, quantitative studies fall under the positivist paradigm and the deductive approach (Alexander, 2014). To explain the research problem in the quantitative method, researchers collect numerical data and then analyze it using statistical techniques to validate the hypothesis.

The advantages of using quantitative analytical methods are numerous. Denscombe (2010) talks about the fact that such methods make it possible to provide answers to closed questions in questionnaires. Additionally, quantitative analysis allows the application of various forms of statistical methods of analysis derived from the principles of mathematics and probability. Another benefit of quantitative analysis is that it increases the level of confidence in the research of interest by performing statistical tests of significance to support the credibility of the researcher's interpretations of data and results (Field, 2009). With quantitative methods, anyone can verify the authenticity of the measurement, as well as the description and analysis of the amounts of data. In addition, quantitative methods allow rapid analysis of large amounts of data (Denscombe, 2010).

Unlike quantitative studies, qualitative studies use subjectivism and attempt to explore the underlying causes of constructs (Creswell, 2003). Bell (2005) argues that researchers who take a qualitative approach are more interested in understanding an individual's perspective on the world. Therefore, a qualitative researcher seeks information rather than statistical perceptions of the world. Unlike quantitative methods centered on positivism, the qualitative method is essentially centered on

interpretivism, adopting an ontological point of view that supports the existence of a number of different truths based on the construction of reality held by an individual (Alkharang, 2014).

Qualitative studies follow the inductive approach and are more useful when I describe a phenomenon subjectively. Also, the qualitative method is used to explain phenomena on which very little literature is available and the relationships between the constructs and the definition are to be described (Gilbert & Stoneman, 2015). But after the development of the constructs, their relationship cannot be proven by qualitative measures; the validation of these relationships requires quantitative methods and the use of statistics (Collis & Hussey, 2013). For Creswell (2003), in the social sciences, it is necessary to use numerical data and perform statistical tests to interpret the results, in order to generalize theoretical prepositions.

Interviews are recommended to better understand things like people's emotions, opinions, feelings and experiences (Denscombe, 2010; Litchman, 2009). In Study 2, I collected qualitative data from case studies in the literature, and then based on this data, we conducted an online interview with staff of e-learning systems in selected higher education schools in Gabon. As recommended by Bell (2005), I made sure that the participants knew beforehand the purpose of the interview and obtained informed consent in accordance with ethical standards.

Like quantitative methods, qualitative analysis also has several advantages. For Denscombe (2010), allowing the acceptance of vagueness and oppositions as well as allowing the researcher to use their interpretative skills are great advantages of qualitative analysis, since it is possible to obtain more than one explanation. However, qualitative research requires a great deal of researcher time during interviews, transcription and data coding.

IS researchers have implemented a more feasible and realistic view: the pluralistic approach using quantitative survey followed by qualitative methodology in interviews, or vice versa, thus suggesting that quantitative and qualitative approaches do not oppose each other but rather should be used in a complementary way in order to provide better and deeper understanding, thus establishing stronger results and conclusions.

4.2.4. Mono-method research and Cross-sectional time horizon

Mono, mix and multi methods are the three choices we've got in research. In the mono-method, the researcher uses a single data collection technique (quantitative or qualitative) and corresponding analysis of collected data. Mixed methods approach employs quantitative and qualitative techniques either in

parallel (at the same time) or in sequence (one after the other) without combining them together. Whereas, the multiple method consists of using more than one way of collecting data.

Since I'll be collecting quantitative data using a structured questionnaire for the research questions of Study 1 and qualitative data using study cases for the research questions of Study 2, hence, I've applied a mixed method of study, using both quantitative and qualitative methods, one after the other.

The time horizon is related to the observation time for a study, either one observes a phenomenon in one round or multiple rounds (Saunders, Lewis, & Thornhill, 2009). The choice of a time horizon depends on the nature of the study or research questions. Cross-sectional studies (gathering responses into a single snapshot) and longitudinal studies (gathering data over a period of time) are the main time horizons used by researchers.

Cross-sectional studies are conducted to investigate a phenomenon at a given time and often use a survey strategy (Easterby-Smith, Thorpe, & Jackson, 2012), although short interview case studies can also be applied. The longitudinal study, however, aims to answer the research question by observing people over a long period of time and studying their development over time to draw a conclusion based on the discovery of past and post development.

For the current study, the cross-sectional time horizon will be adopted for Studies 1 and 2; and survey and interview strategies will be used to collect observations.

4.3. Schematic view of the research methodology

My research study aimed to obtain information on the effectiveness of the implementation of e-learning systems within universities. Johnson (1994) recommends a research approach based on carrying out a set of predefined activities. These activities include setting the direction of the study, identifying specific study objectives, selecting the research method, obtaining research approval, developing the research tool, data collection, data analysis, communication and distribution of results and conclusions. I have chosen Johnson's approach because it is grounded in principles and methods for conducting educational research. This approach has been adapted as shown schematically in Figure 4.2 which illustrates the entire research study.

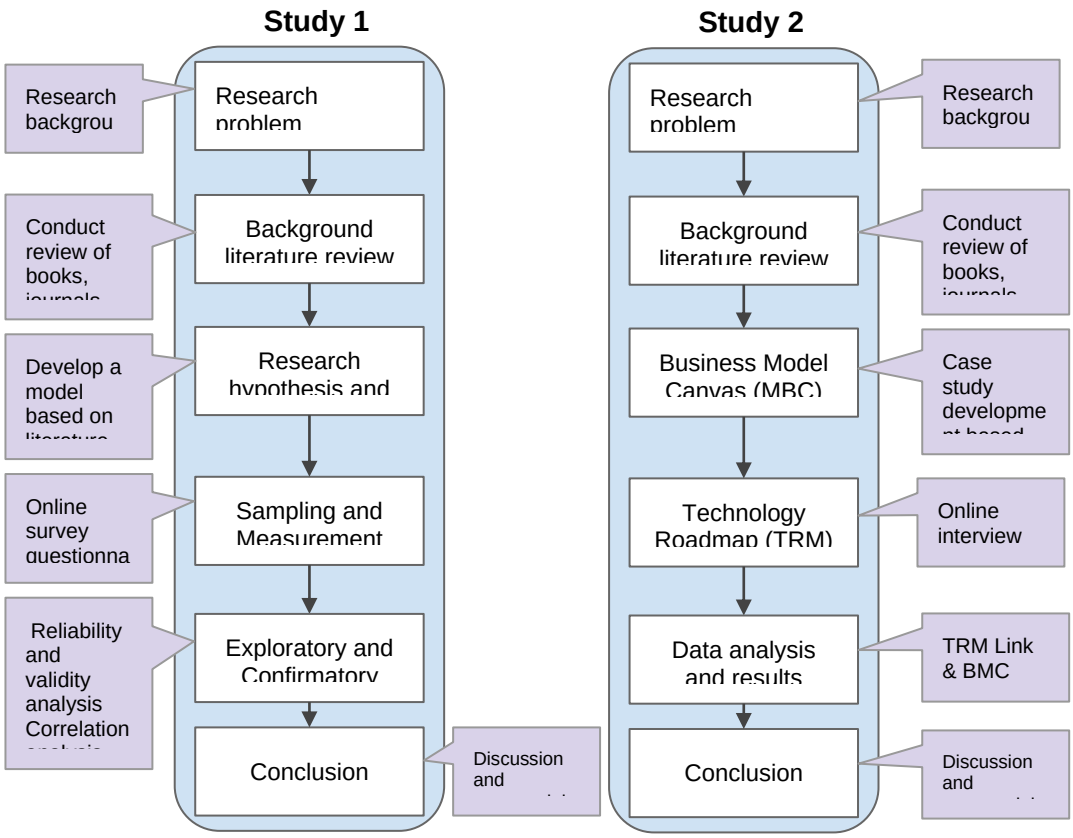


Figure 4.2: Schematic representation of the research methodological approach

4.4. Overview of Study 1 research methodology

4.4.1. Background literature review

The literature review aims to collect relevant and timely research on the chosen topic and synthesize it into a merged synopsis of existing knowledge in the area of research. This then prepares researchers to make their own argument on this topic or conduct their own original research. The purpose of a literature review for a researcher is to provide knowledge based on the topic and identify areas of prior academic achievement to avoid duplication and give credit to other researchers. Additionally, it helps to identify research gaps, conflicts in previous studies, and open questions left by future research.

As already mentioned, the ongoing work aims to shed more light on the success factors of an effective implementation of an e-learning system within universities. For simplicity, I have divided my work into two studies: a first one which aims to study the antecedent factors of perceived usefulness and use (two main constructs used to evaluate the effectiveness of e-learning systems), and a second one

which aims to provide a sustainable business model framework for the effective implementation of e-learning systems in higher education.

The literature review for Study 1 aimed to gather relevant and timely research on the success factors of e-learning systems. The majority of research articles on this topic have relied on the model developed by DeLone and McLean (2003; 1992). Other authors like Davis (1989), AY Alsabawy et al. (2016) and Urbach et al. (2010) have also worked on the subject and their contributions are significant in this field.

The review of the literature on the subject revealed a gap in the field of research: the majority of articles concluded that the antecedent factors of perceived usefulness and use were related to technology (quality of the system, quality of information and quality of service), while some cases have shown that having a very sophisticated e-learning system does not guarantee its use (Crawford & Persaud, 2013). In developing countries where e-learning as an education system is still in the adoption phase, users (students, teachers and staff) may need some technological confidence because simply having access to technology is obviously not enough (Annika and Åke, 2009). Students also need experience with computers in primary and secondary schools to increase their willingness to use online learning systems once in universities. Therefore, we speculate that prior knowledge might be an antecedent to *perceived usefulness* and *use*. Self-motivation could also be a determining factor since e-learning systems provide the opportunity to learn at one's own pace.

This lack of research on individuals' characteristics as antecedents of perceived usefulness and use leads me, in Study 1, to expand knowledge on the success factors of e-learning systems by including some individual characteristics such as prior knowledge, self-regulated learning and consistency of interests. Chapter IV deals with the research methodology of study 1 in more detail.

4.4.2. Research hypothesis and model

A theoretical model is a framework that researchers create to organize a study procedure and plan how to approach a specific research. This can allow them to determine the purpose of their research and develop an informed perspective. A conceptual model, on the other hand, is a framework that is first used in research to define possible courses of action or to present an idea or thought. When a conceptual model is developed in a logical way, it will bring rigor to the research process.

While a theoretical framework describes the theoretical underpinnings of their work based on existing research, a conceptual framework allows them to draw their own conclusions, mapping the variables they can use in their study and the interaction between them.

This stage of the research describes the process of developing the initial theoretical and conceptual model (more detail in Chapter IV). The initial model was developed based on a review of the literature, so information from previous work on e-learning system success, perceived usefulness, types of learning behavior, knowledge background and courage. The objective was to answer the research questions of Study 1: What factors affect *perceived usefulness* and *use* for the effectiveness of e-learning systems? Do individuals' characteristics such as *prior knowledge (PK)*, *self-regulated learning (SRL)*, and *consistency of interests* (CI) play a significant antecedent role for the dependent factors (*perceived usefulness*) in the proposed model?

4.4.3. Sampling and measurement items

Population and Sampling

A population is the total group about which the researcher wants to draw conclusions. The identification and selection of the population is very crucial for the success of the research, as it will help the researcher to generalize the results drawn from the sample. Before selecting the sample size, identifying the population helps to clarify the researcher's problem and the proposed theories in a better and successful way (Figure 4.3). For Bryman & Bell (2011), a target population is the universe of units from which the sample must be selected. This research aims to study the success factors of the implementation of online learning systems within universities. My target population is therefore the users of these e-learning systems, i.e. students, teachers and IT staff of higher education institutions in Gabon. However, it is not possible to use the whole population for the study, so a sample will be selected from my target population and the results will be generalized.

An appropriate selection of a sample from a target population is very essential for unbiased data collection and helps to generalize findings appropriately (Bryman & Bell, 2011). A sample is defined as a selected part of the target population, which is chosen carefully to draw a conclusion so that the results can be generalized to the entire target population. According to Fowler (2009), sampling choice, sampling frame, sample size and response rate are four important factors that must be carefully considered when sampling.

Figure 4.3: Population and sampling. Source: www.scribbr.co.uk/

Sampling choice is the recognition of respondents and the importance of their response to the desired objective. Sampling choices can be categorized into "probability sampling" and "non-probability sampling" (Bryman and Bell, 2011). In probability sampling, each person in a population has a known and equal chance of being selected as a member of the sample size, whereas in non-probability sampling, the chance of selection for each person in a population is unknown or unequal. For the present study, participants were identified using a non-probability sampling technique called "convenience sampling", with the selection of respondents within the target population being easy to access. *Convenience sampling* is quick, easy and the least expensive of all sampling techniques. Study participants were then selected because they could easily be contacted and reached. Participants were identified from the following universities: National Institute of Management Sciences, Omar Bongo University, University of Health Sciences and other private higher education institutions. More details in Chapter IV.

It is clear that the use of the entire population for the study is not possible. For this reason, selecting a relevant sample size is quite a difficult process. A large sample size does not guarantee precision, but a small sample size would increase the chances of failure and misinterpretations. Hair et al. (2010) mentions that when using Structural Equation Modeling (SEM), if the number of constructs is greater than 6, the sample size should be 400 (in general between 200 and 500). Since I'm going to use SEM for the data analysis of my conceptual model of 8 constructs, I targeted a sample size of 500 respondents.

Measurement items

After defining an appropriate sample size, the next step is to collect responses from this selected sample. According to Zikmund (2003), the instrument used in the research must be able to achieve two objectives: first, the "construct validity", that is, *the instrument must be able to measure the answers to the research questions*; on the other hand, the "reliability of the construct", *evaluation of the degree of coherence of a variable or a set of variables in what it intends to measure*.

In the present study, for the research questions, a quantitative approach using a questionnaire-based survey would be developed with two main sections, one for the demographic questions and a second for the construct-based questions. A questionnaire is a data collection tool without the precondition of having input from the interviewer to the respondent while completing the questionnaire (Blair et al., 2013). The questionnaire instrument has several advantages, such as being the basic and most popular research instrument in quantitative studies.

For Moustakas (1994), questionnaires are considered to have a better score compared to other survey methods, are less expensive to administer and do not depend on the presence of the researcher. Additionally, paradigms for collecting information or data collected from questionnaires have been found to be easier since responses collected from questionnaires follow an almost identical structure. However, despite these advantages, the structure of the questionnaires is considered to have some disadvantages. First, the common response format tends to irritate some participants. Second, if participants are unable to understand the questions, their answers may become vague and this could render the entire data collection process useless. However, respondents were provided with essential information to explain the aims and objectives of the research.

It can be divided into unstructured questions (open-ended questions implying that respondents will answer in their own words) and structured questions (questions can have multiple choices, scale or be dichotomous) (Malhotra, 2008).

The questionnaire was developed based on the research literature with particular emphasis on the adoption of information technology and the effectiveness of the implementation of e-learning systems. The original questionnaire was developed in English, and then translated into French (Appendix B) because the respondents did not speak English, since French is the official language in Gabon. Finally, the French version was translated back into English by an interpreter. I considered accuracy, fluency and usability in terms of translation, as inefficient and inaccurate translation could lead to misinterpretation and misunderstanding (Saunders et al., 2011).

The study was limited to students, teachers and IT staff of higher education institutions in Gabon. The sample was chosen not only for practical reasons and convenience, but also because university students, teachers and managers are among those whose opinions and perceptions will influence the implementation of learning systems in their organizations (Aldhafeeri et al., 2006). Chapter V gives more information on how exactly that questionnaire was used.

4.4.4 Exploratory and confirmatory data analysis and results

Exploratory Vs Confirmatory

The exploratory research model and the confirmatory research model are two different but complementary components of the same goal: to discover relevant results in the most efficient, reliable, reproducible and applicable way. *Exploratory research* is one of the most useful tools to be even more efficient in science and the type of tools it requires are absolutely different from those used in confirmatory research. Exploratory research is when researchers focus on explaining and describing potential relationships in the most general way, allowing multivariate approaches to predict any subsequent relationship. *Confirmatory research* in the other hand is used to confirm a pre-established relationship between variables. In other words, when implementing exploratory studies, the research does not seek to validate the relationships described before the analysis; rather, the data and the approach are used to define the nature of the relationships between the variables in the models (Hair et al., 2006). Similarly, a confirmatory approach predicts empirical results as a means of confirming or disproving a previously specified hypothesis.

Thus, the work of Gerring (2001) and Hair et al. (2006) on the difference between confirmatory research design and exploratory research design found that confirmatory research approaches are generally preferred by researchers with both theoretical and experimental interests; on the other hand, those who take a more behavioral or interpretative position generally prefer an exploratory research approach.

The majority of studies conducted in the social sciences fall between the confirmatory and exploratory ideals, but both types of research approaches have some degree of limitation (Gerring, 2001). The exploratory approach means that falsifying the theory is problematic; thus, the results are generally over-fitted with a high probability of bias. In contrast, confirmatory studies depend on the deductive approach and statistical guesswork (Meyers et al., 2006), with hypotheses described first and then tested in order to provide an answer to particular questions. This suggests the benefits associated with

confirmatory analysis of providing accurate data while implementing well-established methods and theory. Be that as it may, however, the drawbacks of the confirmatory study approach can be seen in the analysis driven by fixed and predetermined ideas, and the problems associated with establishing unexpected results.

Both methods will be used in Study 1. I will first use an exploratory research method to verify potential relationships between the variables of the proposed model, then a confirmatory research method to confirm a pre-established relationship between constructs.

Structural Equation Modeling

Structural Equation Modeling (SEM) is a set of statistical techniques used to measure and examine relationships between observed and latent variables. Almost identical to (but more powerful than) regression analyses, SEM examines linear path relationships between variables, while accounting for measurement error. SEM is a very popular method in information science, used to confirm theorized concepts and involves covariance analysis and path analysis with dormant variables (Gefen, Straub, & Boudreau, 2000). Hair et al. (2010) define SEM "as a multivariate technique, which combines features of multiple regression and factor analysis in order to simultaneously estimate a multiple of network relationships".

SEM also examines whether the data fits the hypothesis model and is very important in confirming model constructs (confirmatory factor analysis, i.e. CFA). It also helps the researcher determine the validity and readability of the construct at the variable and item level. Confirmatory factor analysis is performed on the constructs extracted by exploratory factor analysis; otherwise it cannot be used in further analysis. SEM makes the relationship between independent and dependent variables more reliable than with any other technique.

SEM is distinguished by its concurrent analysis capability, where relationships between multiple independent and dependent constructs are modeled simultaneously. This capability differs greatly from most first-generation statistical tools such as correlation, regression, and factor analysis, which can examine only one layer of relationships between independent and dependent variables at a time (Chin and Todd, 1995). SEM not only assesses causality among a set of dependent and independent constructs (the structural model analysis), but in the same analysis also assesses the loadings of the measures on their expected constructs (the measure model analysis). Thus, in SEM, factor analysis and hypothesis testing occur at the same stage. The data analysis tools SPSS and AMOS will be used in this study (see Chapter V).

4.4.5 Discussion and Conclusion

This section focused on the overview of the methodology applied in Study 1 of my research work, more detailed in Chapter V. This Study 1 aims to learn more about the effectiveness of the implementation of e-learning systems in universities in Gabon; specifically, uncover the important factors influencing the *perceived usefulness* and *use* of e-learning systems. This methodological process involved first doing a background literature review, and then defining the research design model and hypothesis; then, after determining the sampling and measurement of the elements proceed to the statistical analysis, discuss the results and finally draw conclusions.

As part of the study, a quantitative research method was used to collect quantitative and relevant data from the study participants (students, teachers and IT staff) who were recruited from numerous public and private universities operating in technology-enhanced learning environments in Gabon. Questionnaires with google forms were the instruments used during the study and after data collection, SPSS and Amos were used for data analysis. At the end of Chapter V, I give the conclusions of this Study 1, as well as the theoretical and managerial implications, and finally the limits and directions for future research in the field.

4.5 Overview of Study 2 research methodology

4.5.1 Background literature review

As in Study 1, the literature review in Study 2 also aims to collect relevant and timely research on the chosen topic and place the research in the context of the existing literature. Study 2 of my research aims to provide a sustainable business model framework for effective e-learning systems in higher education in Gabon.

The literature review for Study 2 aimed to gather relevant and timely research on the definition of e-learning, implementation challenges of e-learning systems, business models, the Business Model Canvas (BMC) and the Technology Roadmap (TRM). The majority of research articles on this subject were based on the BMC developed by Osterwalder & Pigneur (2009) and on the TRM model developed by (Phaal et al., 2004a). Other authors like Cosner et al. (2007), and de Reuver, Bouwman and Haaker (2013) have also worked on the subject with significant contributions in the field. The review of the literature on the subject revealed the need to pay more attention to the "e-learning readiness" of providers (public and

private higher education institutions), even if the users (students, teachers and IT staff) perceive ICT in education as useful and demonstrate the ability and willingness to use it.

Adopting e-learning technology as an educational system without planning can be very costly in terms of time, money and energy (Rohayani et al., 2015). Based on previous studies, an institution's readiness to adopt e-learning as an education system is measured in terms of technical, content, human and financial resources. Universities willing to adopt e-learning systems should therefore ask themselves certain questions: are we ready to install and maintain this technology? Are we strong enough to beat the competition?

Therefore, two valuable management tools, Business Model Canvas (BMC) and Technology Roadmap (TRM), are proposed to assess the effectiveness of e-learning implementation and provide a sustainable business model framework for a successful e-learning system. Chapter VI discusses the research methodology of Study 2 in more detail.

4.5.2 Business Model Canvas (MBC) and Technology Roadmap (TRM) for the case study

This step aims to develop a case study model based on a literature review. I have completed the 9 building blocks of the business model canvas based on world famous learning platforms such as edX, Coursera, Udacity, Udemy and Codecademy (Cornejo-Velazquez et al., 2020). These study case templates will help us get more specific information, different expertise and knowledge through an interview with a group of potential users, as well as IT and business experts and managers from two different universities in Gabon, namely the National Institute of Sciences management and Omar Bongo University.

BMC and TRM will be developed separately but simultaneously, and then will be linked to establish an effective business model canvas for the current and future situation of the company, taking into account market trends and the technological evolution brought by TRM (Toro-Jarrín et al., 2016).

Finally, in order to illustrate and validate the methodology, I apply the BMC and TRM integration to an existing online learning system named SCIENTIA in Gabon. SCIENTIA is an e-learning platform that allows the management and monitoring of all school life in middle and high school in Gabon (courses, transcripts, attendance, exams, homework, report card, parental monitoring, etc.). This work could help the SCIENTIA management team to create and develop the same (if not better) e-learning system for higher education in Gabon.

4.5.3 Data analysis and results

The last step is step 5, where all the information retrieved so far is taken into account. For the two strategic management tools, BMC and TRM, the market, product and technology levels were developed by the research team. The next step is to link the TRM levels, using connection grids, and integrate the BMCs according to each period.

The team identified all the blocks needed to integrate the business model; it is suggested to produce many possible BMCs for each time period (now, medium term and long term) with variations between blocks, models, customer segments, etc., and then evaluate them. BMCs can be tested using the storytelling tool.

With all the information gathered, each formulated BMC should be more detailed. Finally, an analysis is performed to assess the alignment between the created models and the company's strategy (Pillkahn, 2008).

To stay focused on the relevant points, it is important that team members think about the expected results at each stage; it is also to ensure that at the end of the whole process, the team will have all the blocks for the BMC integration and the levels for the TRM link grids. BMCs should be reviewed periodically to track changes and assess achievements and progress.

In this last phase, a general summary analysis was carried out with the aim of evaluating all the 5 stages of the BMC and TRM articulation and of seeking the elements which make it possible to build a good BM. In addition, all information has been added on an empty TRM model and the paths have been identified.

The results show the integrated BMC for the considered SCIENTIA case study, only for the mid-term period. Although it was suggested that the BMC should be developed for each period of analysis (now, medium term and long term), in this case we chose a medium term period (four years) for the building integration process, and they wanted to visualize a single BMC. The information gathered was used in the construction of the TRM and the final product will be presented.

To simplify this analysis on all phases, an automated tool can be developed in order to help the management team to know the next subjects to be treated and to have the description of all the questions for each phase; once the team has answered all these questions, they build the two tools following the methodology described above.

4.5.4 Discussion and Conclusion

This section has focused on the overview of the methodology applied in Study 2 of my research work, more detailed in Chapter VI. This Study 2 aims to learn more about sustainable business models for learning systems online, more specifically on the integration of two powerful management tools, i.e. Business Model Canvas (BMC) and Technology Roadmap (TRM). This methodological process involved first doing a background literature review and then developing a case study design based on a literature review; after BMC and TRM were developed separately but simultaneously, they were linked to establish a more efficient business model. Finally, I validated the methodology by applying the BMC and TRM integration to an existing e-learning system named SCIENTIA.

As part of the study, a qualitative research method was used to collect relevant data from potential users, as well as IT and business experts and managers from two different universities in Gabon, namely the National Institute of Sciences management and Omar Bongo University. Interviews were the instruments used during the study for data collection. At the end of Chapter VI, we give the conclusions of this Study 2, as well as the theoretical and managerial implications, and finally the limits and orientations of future research in the field.

4.6 Ethical considerations

According to Cousin (2009), before starting any research assignment, it is important to ensure that all ethical standards, consents and approvals are applied at every stage.

Researchers should protect the rights of participants and inform them of the research process and risks before collecting data. Participants should know that the data collected will be used for the good of the research and will remain private. They must be informed that their identity will remain unknown throughout the search. Respondents must agree to participate in the research and no data should be used without their consent.

In this research, approval to collect data was received from the participants. Since questionnaires and interviews were used to collect data in this research, all participants already knew and agreed to three important things:

- Respondents agreed to participate in the research knowing that the data will be used in the research.
- The participants were informed that their personal data will always remain anonymous.

- The participants understood their right to interrupt the interview at any time or not to answer any questions.

This process helped us get the honest opinion of the respondents; after data collection, ethical concerns were also checked during the data analysis and reporting stages. Cousin (2009) mentions five important considerations to be adopted by researchers engaged in the research process: reflectivity, reliability, intellectual capacity, corroboration and social responsibility. Reflectivity is the recognition that the data obtained are likely to be influenced by the frame of the questions, the research methods and tools adopted, and the interpretations derived. Reliability relates to how interviews and focus group discussions are factored in, as the reliability of the results must be double-checked to ensure the accuracy of assumptions. The researcher is expected to be intellectually informed by developing strong and convincing arguments with an adequate review of the literature to support the theoretical claims made. Corroboration is the sharing of research findings and results with research subjects and/or other researchers in academia as well as industry through conferences, poster competitions, seminars and workshops. Journal articles (Cousin, 2009). With respect to social responsibility, the researcher has championed issues of fairness, quality, academic freedom, and respect for other researchers by safeguarding the rights, dignity, and confidentiality of participants.

CHAPTER V Research Methodology of Study I

5.1 Research hypotheses and model

5.1.1 Research hypotheses

Antecedents of Perceived usefulness

The Technology Acceptance Model (TAM), developed by (Davis, 1989) is one of the most widely recognized models for understanding users' acceptance of technology. According to TAM, perceived usefulness is a critical determinant of users' intentions to use a technology. System quality, including factors such as reliability, ease of use, and functionality, is considered an important antecedent of perceived usefulness. Several studies have supported this relationship, highlighting the positive impact of system quality on users' perceived usefulness and subsequent technology adoption.

DeLone and McLean (1992) proposed an influential model that aimed to measure the success of information systems. This model suggests that system quality, along with other factors like information quality, service quality, and user satisfaction, contributes to the overall perceived usefulness of a system. Researchers applying this model have found empirical evidence supporting the positive impact of system quality on perceived usefulness. Rai et al. (2002) and Petter et al. (2008) also found that system quality has an impact on the success of e-learning.

If educational institutions provide students and teachers with a well-structured, easy-to-navigate e-learning system with easily accessible content, they will be encouraged to perceive the usefulness of this system and actually use it. Studies also demonstrate that user experience and learning are enhanced by the navigability, accessibility, structure, visual logic and stability of e-learning systems and that system quality has a positive impact on usage and satisfaction (Aparicio et al., 2017; Urbach et al., 2010). Therefore, I hypothesize that H_1**:** *System quality is positively related to Perceived Usefulness.*

According to TAM, perceived usefulness is a significant determinant of users' intentions to use a technology. Information quality, which encompasses attributes such as accuracy, relevance, completeness, timeliness, and understandability of information, is considered an important factor influencing users' perceived usefulness. Several studies have supported this relationship, indicating that higher information quality leads to increased perceived usefulness and subsequent technology adoption (DeLone & McLean, 1992).

Students and teachers use e-learning systems for the information and content (videos, slides, manuals, forums, and links, among others) available there and they expect the content to be understandable and adapted to their needs. Thus, in e-learning systems, the quality of information is an important determinant

and this quality is related to the accuracy, content clarity, relevance and sufficiency of information (DeLone & McLean, 1992; Petter et al., 2008; Rai, Lang, & Welker, 2002).

Any e-learning system has two dimensions: the functionality of the system and the information contained in the system. Both information quality and system quality have been found to have a significant impact on perceived usefulness. (Marton &Choo, 2002; Viswanath and Davis, 2000). I therefore suggest that H_2**:** *Information quality is positively related to Perceived usefulness.*

The model of DeLone & McLean (1992) suggests that service quality, along with other factors such as system quality, information quality, and user satisfaction, contributes to the overall perceived usefulness of information systems. Empirical studies applying this model have found evidence supporting the positive impact of service quality on perceived usefulness.

In the field of e-learning systems, service quality is assessed by the ability and willingness of IT personnel to solve any technological infrastructure problems that may arise (Pitt et al., 1995; Urbach et al., 2010). Users also appreciate the fact that the help desk provides the necessary attention to solve their difficulties. In the context of e-learning, service quality positively influences e-learning usage and student satisfaction (Aparicio, Bacao, & Oliveira, 2017; Machado-Da-Silva et al., 2014). Having a support staff ready to provide assistance if there is a problem with the system can encourage users to have a positive feeling about its usefulness. Therefore, we hypothesize that H_3**:** *Service quality is positively related to Perceived usefulness.*

Studying the challenges of e-learning implementation, papers on technological challenges are more than those dealing with individual challenges (Annika and Å ke, 2009). Even the e-learning system success model proposed by DeLone and McLean (2003) is mainly focused on the technology, through system quality, information quality and service quality. Nevertheless, some researchers have improved e-learning system success by adding factors related to people and have found significant impacts of those factors on e-learning system success (Aparicio et al., 2016; Ren et al., 2017; Garcia et al., 2018). Thus, this current research proposes to pay attention to the impact of individuals' characteristics like prior knowledge (PK), self-regulated learning (SRL) and Grit in influencing Perceived Usefulness of e-learning systems. Indeed, what's the use of creating a costly and sophisticated system that nobody wants to use or that people use just for a short period of time?

Prior knowledge is the knowledge the learner already has before they meet new information. In the e-learning area, Prior knowledge has been studied by Mitchell et al. (2005) who argued that the e-learning effectiveness of learners is influenced by their level of prior knowledge. Users with a good prior knowledge in computer related tasks in general and in e-learning in particular have more intention to use

e-learning systems than those with a low prior knowledge. Prior knowledge is then a determinant factor related to e-learning effectiveness. Therefore, the current research hypothesizes that H_4**:** *Prior Knowledge is related positively to Perceived usefulness.*

With e-learning, students and teachers can have access to courses at any time, from anywhere and can learn or create content at their own pace; so they have to take an active control over their learning goals (Garcia et al., 2018). According to Zimmerman (1989), self-regulated learners are those that plan, set goals, organize, self-monitor and self-evaluate their educational programs. So self-regulated learners could set interesting learning goals by themselves, make an organized study plan, manage their own learning (Heikkila and Lonka, 2006), and improve their motivation and understanding in the e-learning process (Hu and Gramling, 2008). Users who are able to Self-regulate their learning or teaching are more likely to perceive the usefulness of e-learning systems and actually use them than those who are incapable of self-regulation. Therefore, the current research hypothesizes that H_5**:** *Self-regulated Learning is related positively to Perceived usefulness.*

Grit is another individual characteristic that could have an impact on e-learning system success. Grit is a personality trait characterized by passion and perseverance towards long-term goals. Grit, as a concept, was introduced by Duckworth et al. (2007). Their research focused on the relationship between grit and achievement, particularly in educational settings. The studies indicated that individuals with higher levels of grit were more likely to achieve their goals and persist in the face of challenges.

Moreover, the concept of Grit is measured by two different sub-factors which are Perseverance Effort (PE) and Consistency of Interest (CI) (Duckworth et al., 2007). For more simplicity, in the current research I'm only considering Consistency of Interest (CI) which relates to the ability to pursue a set of pre-defined objectives and stay focused on those goals.

According to Aparicio et al. (2017) Grit is the individual persistence and continuous effort to achieve long-term goals. Since learning is a long-term process, these authors had hypothesized that learners who usually don't give up in difficult situations and continue to strive until their goal is achieved may be more likely to use e-learning systems. Even though this hypothesis was not supported, they suggested the comparison between various countries. While the direct relationship between grit and perceived usefulness has not been extensively examined in the literature, the concepts of grit, achievement, motivation, and well-being provide a foundation for understanding the potential impact of grit on perceived usefulness. Based on the above, I hypothesize that H_6**:** *Consistency of Interest is related positively to Perceived usefulness.*

The Technology Acceptance Model, developed by Davis (1989), is a widely recognized model for understanding users' acceptance of technology. According to TAM, perceived usefulness is a crucial determinant of users' intentions to use a technology. Several studies have supported this relationship, indicating that when users perceive a technology as useful in facilitating their tasks or achieving their goals, they are more likely to actually use it.

The Theory of Reasoned Action (TRA) and its extension, the Theory of Planned Behavior (TPB), provide theoretical frameworks for understanding human behavior, including technology use. These theories propose that individuals' intentions to perform a behavior (e.g., using a technology) are influenced by their attitudes towards the behavior, subjective norms, and perceived behavioral control. In the context of technology, perceived usefulness represents a positive attitude towards using the technology, and studies have consistently found a positive relationship between perceived usefulness and actual use.

The Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. (2003), identifies four key determinants of technology acceptance: performance expectancy (perceived usefulness), effort expectancy, social influence, and facilitating conditions. Perceived usefulness is considered a central factor in influencing users' intention to use and actual use of a technology. Therefore, based on the above, I hypothesize that H_7**:** *Perceived usefulness is related positively to usage (Use).*

5.1.2 Research model

Based on the above hypotheses, the research model is shown in Figure 5.1. The main constructs are perceived usefulness and usage. The first part of the model concerns the technological antecedents (system quality, information quality and service quality) and individual antecedents (prior knowledge, self-regulated learning and consistency of interests) of perceived usefulness. The last part of the model concerns the relations between perceived usefulness (exogenous construct) and use (endogenous construct).

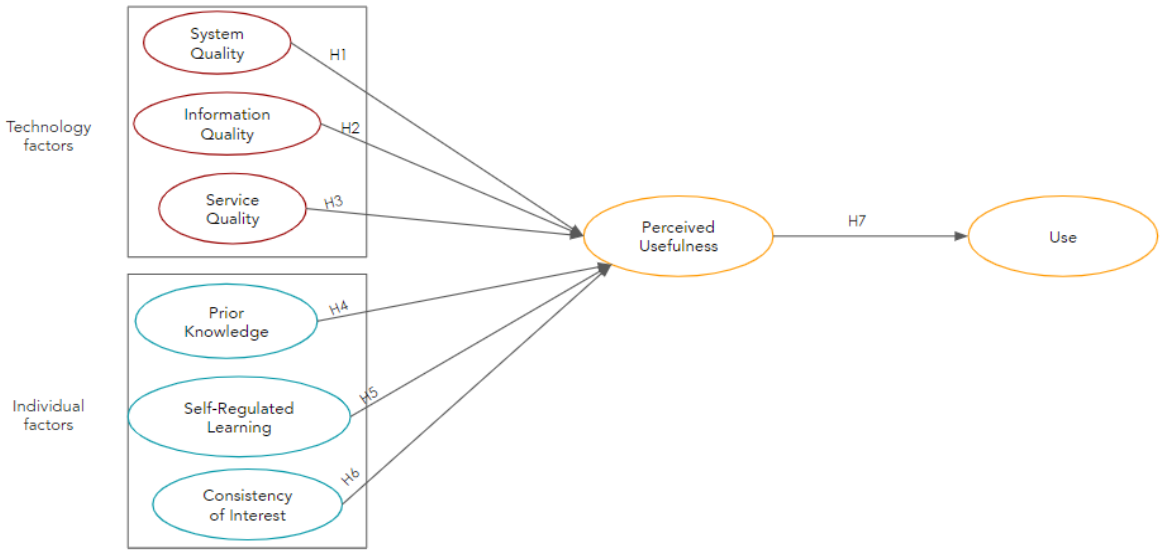


Figure 5.1: Research model

5.2. Sampling and measurement items

5.2.1 Sampling

An online survey questionnaire was used to collect data through a google form (**Appendix B**). The respondents are all from Gabon and essentially students and teachers all in higher education. From a total of 415 responses obtained, I removed 58 incomplete and invalid replies and 357 responses were used for estimating the proposed research model. The sample is composed of students and teachers from 7 different universities located in two major cities as proposed by previous studies (W.A. Cidral et al., 2018).

Sample profile is shown in Table 5.1. 64.1% of the total respondents were male and 35.9% were female. Only one respondent (0.3%) was over 55 years old and 11 respondents (3.1%) under 18 years old. Others are 18 to less than 30 years old (62.2%), 30 to less than 45 years old (23.5%) and 45 to less than 55 years old (10.9%). Moreover, 38 (10.6%) of participants were under bachelor, 133 (37.2%) were bachelor, 125 (35%) were master, 61 (17.1%) were doctors of philosophy. Regarding their employment status, 286 (80.1%) are students, 68 (19%) are teachers and 3 (0.8%) are mixed workers, unemployed, etc.

Regarding universities, 134 (37,5%) are from the National Institute of Management Sciences, 114 (31.9%) from University Omar Bongo, 60 (16.8%) from University of Health Sciences and 49 (13.7%) from private higher education institutions classified as “Other” in the survey.

Table 5.1: Sample profile

Demographic variables		Frequency	%
Gender	Male	229	64.1
	Female	128	35.9
Age	Under 18 years old	11	3.1
	18 - 29 years old	222	62.2
	30 - 44 years old	84	23.5
	45 - 54 years old	39	10.9
	55 years old or over	1	0.3
Education	Under bachelor	38	10.6
	Bachelor	133	37.2
	Master	125	35
	Doctors	61	17.1
Employment Status	Student	286	80.1
	Teacher	68	19
	Other	3	0.8
Universities	National Institute of Management Sciences	134	37.5
	University Omar Bongo	114	31.9
	University of Health Sciences	60	16.8
	Other	49	13.7

5.2.2 Measurement items

The questionnaire was developed based on the literature review. There are 8 constructs in the questionnaire: System Quality, Information Quality, Service Quality, Prior Knowledge, Self-regulated Learning, Consistency of Interest, Perceived Usefulness and Use. Five-point Likert scales rating from 1 = strongly disagree to 5 = strongly agree were used to measure 7 constructs; except the Use which was measured by a seven-point Likert scales rating from 1 = not at all to 7 = several times a day, to indicate the extent to which they use the e-learning system to perform certain tasks.

The items for System Quality, Information Quality and Service Quality were adapted from DeLone & McLean (1992, 2003) and Urbach et al. (2010), the items of Prior Knowledge were derived from study of Mitchell, Chen, & Macredie (2005) and Wang (2010). The scales for Self-regulated Learning were based on Zimmerman and Martinez-Pons (1986). The items for Consistency of Interest (grit) were derived from Duckworth & Quinn (2009). The scales for Perceived usefulness were based on Davis (1989) and the items for Use were also adapted from DeLone & McLean (1992, 2003) and Urbach et al. (2010). In total 32 items were considered to make a questionnaire. All measurement items are described in Table 5.2.

Table 5.2: Measurement items

Construct	Code	Indicators	Author
System quality	SysQ1	The e-learning system is easy to navigate.	DeLone & McLean, 1992, 2003; Urbach et al., 2010
	SysQ2	The e-learning system allows me to find easily the information I am looking for.	
	SysQ3	The e-learning system is well structured.	
	SysQ4	The e-learning system is easy to use.	
Information Quality	IQ1	The information provided by e-learning system is useful.	DeLone & McLean, 1992, 2003; Urbach et al., 2010
	IQ2	The information provided by e-learning system is understandable.	
	IQ3	The information provided by e-learning system is interesting.	
	IQ4	The information provided by e-learning system is reliable.	
Service Quality	SerQ1	The responsible service personnel is always highly willing to help whenever I need support with the e-learning system.	DeLone & McLean, 1992, 2003; Urbach et al., 2010
	SerQ2	The responsible service personnel provides personal attention when I experience problems with the e-learning system.	
	SerQ3	The responsible service personnel provides services related to the e-learning system at the promised time.	
	SerQ4	The responsible service personnel has sufficient knowledge to answer my questions in respect of the e-learning system.	
Prior Knowledge	PK1	I have already taken online courses in the past.	Mitchell, Chen, & Macredie (2005) and Wang (2010)
	PK2	I have taken online courses for along period of time in the past	
	PK3	I have graduated by taking online courses in the past.	
Self-Regulated Learning	SRL1	Self-evaluating: I'm able to evaluate the quality or progress of my exercices and homeworks.	Zimmerman and Martinez-Pons, 1986
	SRL2	Organizing and transforming: I make an outline before starting my work.	
	SRL3	Setting goals and planning: I start studying two weeks befor exams, and I pace myself.	
	SRL3	Seeking information: I use online knowledgebases to assist in further understanding of my courses and exercises.	
Grit (Consistency of Interest)	CI1	I often set a goal but later choose to pursue a different one.	(Duckworth & Quinn, 2009)
	CI2	I have been obsessed with a certain idea or project for a short time but later lost interest.	
	CI3	I have difficulty maintaining my focus on projects that take more than a few months to complete.	
Perceived Usefulness	PU1	Accomplish quickly: using the e-learning system in my study enables me to accomplish my tasks more quickly.	Davis, 1989
	PU2	Improving performance: using the e-learning system improves my study performance.	
	PU3	Increasing productivity: using the e-learning system in my study increases my productivity.	
	PU4	Easier study: using the e-learning system makes it easier to do my study.	
	PU5	Overall usefulness: overall, I find the e-learning system useful to my study.	
Use		(Likert scale 1- not at all, 2-less than once a week, 3-about once a week, 4-two or three times a week, 5-four or six times a week, 6-about once a day, 7- several times a day) Please indicate the extent to which you use the e-learning system to perform the following tasks:	DeLone & McLean, 1992, 2003; Urbach et al., 2010
	Use1	Retrieve information.	
	Use2	Publish information.	
	Use3	Communicate with colleagues and teachers.	
	Use4	Store and share documents.	
	Use5	Execute course work.	

5.3 Data analysis and results

5.3.1. Exploratory Factor Analysis

SPSS and AMOS were used for data analysis. An Exploratory Factor Analysis (EFA) was performed using a principal component analysis and varimax rotation. The minimum factor loading criteria was set to 0.50. The communality of the scale, which indicates the amount of variance in each dimension, was also assessed to ensure acceptable levels of explanation. The results show that all communalities were over 0.70.

Table 5.3: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.770
Bartlett's Test of Sphericity	Approx. Chi-Square	20344.006
	df	496
	Sig.	.000

Kaiser–Meyer–Olkin measure of sampling adequacy (MSA) should be greater than 0.7. Our result of 0.770 indicates that our sample is adequate. An important step involved weighing the overall significance of the correlation matrix through Bartlett's Test of Sphericity (testing the hypothesis that variables are unrelated). The significant value of Bartlett's Test of Sphericity is less than 0.05, so the null hypothesis is rejected, meaning the variables are related to each other.

In this initial EFA, one item (*IQ3: the information provided by the e-learning system is interesting*) failed to load on any dimension significantly. The EFA was repeated without this item. Due to the large number of cross-loading variables, another orthogonal rotation method was chosen (EQUAMAX). Finally, only two variables (*SRL3: setting goals and planning: I start studying two weeks before exams and I pace myself* and Use2: *Publish information*) were deleted for loading onto a factor other than their underlying factors.

EFA was run again. The results of this new analysis confirmed the Kaiser–Meyer–Olkin MSA (0.761). The seven factors extracted explained a total of 86.500 per cent of the variance among the items in the study. The Bartlett's Test of sphericity proved to be significant and all communalities were over the required value of 0.50 (smallest value .681).

Table 5.4: Final KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.761
Bartlett's Test of Sphericity	Approx. Chi-Square	17733.697
	df	406
	Sig.	.000

Factor loadings in the exploratory factor analysis are acceptable. The results of the EFA are presented in Table 5.5.

Table 5.5: Results of exploratory factor analysis

Items	Factor loadings							Eigenvalue	Cumulative explained variance
	1	2	3	4	5	6	7		
PU1	**.817**	.334	.015	.175	-.033	.231	-.105	11.214	38.668
PU4	**.805**	.171	.111	.379	.090	.205	-.104		
PU2	**.802**	.208	.098	.400	.094	.162	-.124		
PU3	**.671**	.173	.243	.428	.023	.269	-.152		
PU5	**.668**	.370	.260	.300	.027	.225	-.152		
SysQ3	.117	**.890**	.185	.245	.045	.121	-.021	4.066	52.690
SysQ1	.236	**.830**	.093	.149	.145	.091	-.110		
SysQ4	.369	**.805**	.059	.240	.152	.137	-.040		
SysQ2	.267	**.792**	.233	.355	.022	.122	-.005		
CI1	-.034	**.610**	-.291	.080	.459	.268	-.257		
Use4	.132	.006	**.941**	.197	.004	.152	.012	3.052	63.214
Use5	.167	.080	**.934**	.082	.036	.209	.021		
Use3	.180	.043	**.930**	.194	-.022	.142	.009		
Use1	-.160	.230	**.832**	.066	.152	.329	.110		
SerQ3	.274	.147	.09**1**	**.830**	.192	.225	.064	2.256	70.994
SerQ4	.052	.282	.348	**.807**	-.037	.138	-.019		
SerQ2	.412	.173	.144	**.800**	.154	.189	.015		
SerQ1	.418	.230	.027	**.714**	.230	.316	.151		
SRL4	-.131	.135	.007	-.167	**-.825**	.022	.186	1.879	77.473
CI2	-.045	.112	.176	.239	**.816**	.084	.062		
SRL1	.203	-.131	.093	.086	**-.711**	-.006	.444		
CI3	.375	.444	-.022	-.092	**.617**	-.022	.012		
IQ1	.103	.293	.290	.326	-.147	**.770**	-.060	1.566	82.873
PK3	.196	.165	-.110	.148	-.381	**-.716**	.263		
IQ2	.499	.013	.208	.260	-.087	**.711**	-.035		
IQ4	.345	.143	.218	.223	-.022	**.649**	.147		
PK1	-.170	.201	.013	-.117	-.001	.015	**.919**	1.052	86.500
PK2	-.069	-.233	.256	.212	-.083	-.235	**.820**		
SRL2	-.030	-.230	-.337	.034	-.463	.205	**.664**		

Extraction Method: Principal Component Analysis.
Rotation Method: Equamax with Kaiser Normalization.

5.3.2. Confirmatory factor analysis and structural equation modeling

The initial fit statistics were way below the recommended levels, so the model needed to be revised. The model fit was gradually improved by removing (one by one) all variables with residual covariances greater than 0.2 (SysQ2, SysQ4, IQ1, IQ4, SerQ3, SerQ4, PK3, SRL3, SRL4, CI1, PU1, PU3, PU5, Use1, Use2 and Use5). The final results are shown in Figure 5.2 and Table 5.16. The revision was stopped to avoid too much variable deletion (only two indicators remaining for each construct) which may negatively affect the measurement model.

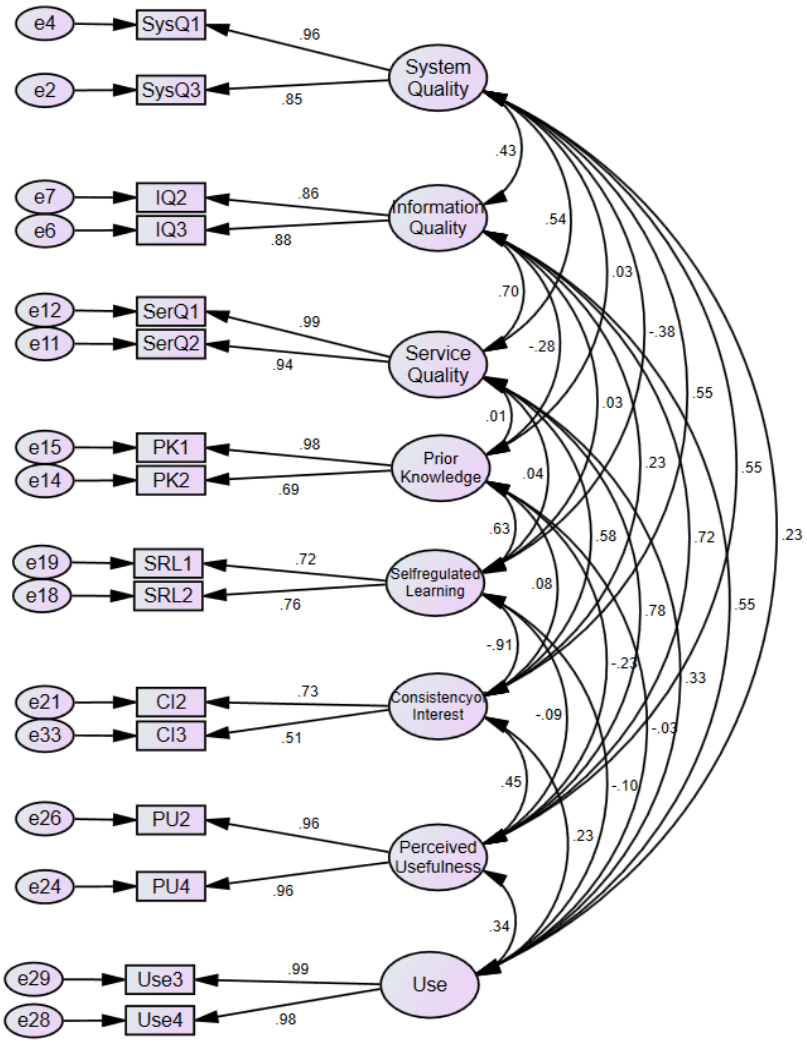


Figure 5.2: CFA measurement model

Table 5.6: Results of confirmatory factor analysis

Constructs	Items	Standardized regression coefficient	Standard error	P value
System quality	SysQ3	.853		
	SysQ1	.956	.046	.000
Information quality	IQ3	.880		
	IQ2	.859	.051	.000
Service quality	SerQ2	.935		
	SerQ1	.988	.025	.000
Prior knowledge	PK2	.693		
	PK1	.981	.089	.000
Self regulated learning	SRL2	.760		
	SRL1	.716	.049	.000
Consistency of interest	CI2	.725		
	CI3	.509	.061	.000
Perceived usefulness	PU4	.959		
	PU2	.963	.023	.000
Use	Use4	.976	.026	.000
	Use3	.987		
Model fit indices	Chi-square = 1190.987, df = 76, p = 0.000, Chi-square/df =15.671 GFI = .746, RMSEA = .205, RMR = .106 NFI = .806 CFI = .814 AGFI = .546, PNFI = .510			

Even though the CFA fit indices are lower than the recommended levels (GFI: 0.746 instead of ≥ 0.90, AGFI: 0.546 instead of ≥ 0.80, NFI: 0.806 instead of ≥ 0.90 and CFI: 0.814 instead of ≥ 0.90), I can say that the model is not too bad.

Construct reliability and validity assessment (composite reliability CR ≥ 0.6; Average variance extracted AVE ≥ 0.5; Cronbach's Alpha ≥ 0.7**)**

Table 5.7: Construct reliability and validity assessment

	CR	AVE	System Quality	Inform. Quality	Service Quality	Prior Knowledge	Self-regulated Learning	Consistency of Interest	Perceived Usefulness	Use	Cronbach's Alpha
System Quality	0.863	0.822	**0.907**								.898
Information Quality	0.858	0.757	.429***	**0.870**							.861
Service Quality	0.971	0.932	.540***	.701***	**0.965**						.961
Prior Knowledge	0.806	0.718	.033	-.278***	.014	**0.847**					.809
Self-regulated Learning	0.755	0.548	-.377***	.032	.040	.630***	**0.740**				.705
Consistency of Interest	0.574	0.397	.547***	.233	.576***	.075	-.909***	**0.630**			.539
Perceived Usefulness	0.939	0.922	.552***	.718***	.780***	-.235***	-.092	.448***	**0.960**		.960
Use	0.942	0.970	.228***	.546***	.329***	-.025	-.098	.230***	.342***	**0.985**	.981

The results in Table 5.7 show that the composite reliability (CR) values for seven constructs are all greater than 0.7 and the average variance extracted (AVE) values are greater than 0.5 for all those seven constructs. One exception for Consistency of Interest with a CR of 0.574 (cannot reach 0.6) and AVE of 0.397 (cannot reach 0.5). This may be due to the fact that this measurement is new. However, even if the CR is low, it's still near to 0.6 (recommended level) and still greater than the AVE. Therefore, the convergent validity of the construct can be considered adequate.

In addition, Cronbach's alpha reliability coefficient was found very high for seven constructs such as System quality (.898), Information quality (.861), Service quality (.961), Prior Knowledge (.809), Self-regulated Learning (.705), Perceived Usefulness (.960) and Use (.981). The exception is made by Consistency of Interest with a cronbach's alpha of 0.539, which is still not far from the 0.6 acceptable level. Therefore, there is no problem with the reliability of the measurement tool.

Structural equation modeling

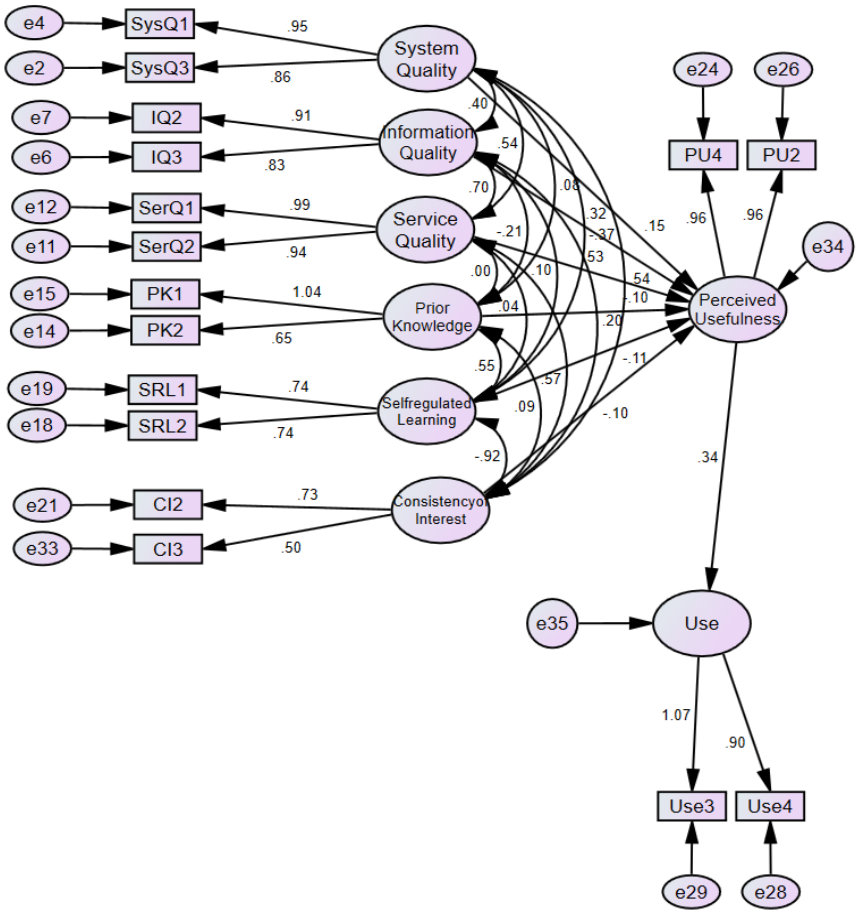


Figure 5.3: Structural equation model

The SEM fit statistics shown in Table 5.8 are lower than the recommended levels (GFI: 0.749 instead of ≥ 0.90, AGFI: 0.584 instead of ≥ 0.80, NFI: 0.796 instead of ≥ 0.90 and CFI: 0.806 instead of ≥ 0.90), but I can still consider that the model is not too bad.

Table 5.8: SEM Fit statistics

chi-square ($\chi 2$) Chi-square = 1247.398 (p= .000) Degrees of freedom = 82 CMIN/DF = 1247.398 / 82 = 15.212
Absolutes Fit Measure Goodness-of-fit index (GFI) = .749 Root mean square error of approximation (RMSEA) = .202 Root mean square residual (RMR) = .135
Incremental Fit Indices Normed fit index (NFI) = .796 Comparative fit index (CFI) = .806 Incremental fit index (IFI) = .807
Parsimony Fit Indices Adjusted goodness-of-fit index (AGFI) = .584 Parsimony normed fit index (PNFI) = .544

Table 5.9: Results of research model

Research Hypothesis		Estimate	S.E.	Standardized coefficient	P value	Results
H1	System quality ⇢ Perceived usefulness	.180	.060	.152	.003	**Supported**
H2	Information quality ⇢ Perceived usefulness	.496	.097	.320	.000	**Supported**
H3	Service quality ⇢ Perceived usefulness	.848	.097	.534	.000	**Supported**
H4	Prior Knowledge ⇢ Perceived usefulness	-.167	.082	-.095	.042	**Rejected**
H5	Self regulated Learning ⇢ Perceived usefulness	-.185	.078	-.106	.018	**Rejected**
H6	Consistency of Interest ⇢ Perceived usefulness	-.166	.061	-.095	.007	**Rejected**
H7	Perceived usefulness ⇢ Use	.463	.064	.345	.000	**Supported**

The SEM analysis results in Table 5.9 show that the factors Information Quality and Service Quality have a significant positive relationship with Perceived usefulness. System Quality also has a positive and almost significant relationship with Perceived usefulness. Therefore, the hypotheses H_1, H_2 and H_3 are supported. The three exogenous constructs Prior Knowledge, Self-regulated Learning and Consistency of Interest have negative and almost significant (respectively p = .042, p = .018 and p = .007) relationships with the endogenous construct Perceived usefulness. Therefore, the hypotheses H_4, H_5 and H_6 are all not supported. Finally, Perceived usefulness has a significant positive relationship with Use, so H_7 is supported.

5.4. Conclusion and Discussion

5.4.1 Discussion and managerial implications

This first study of my work attempted to understand the success factors of e-learning systems, specifically in developing countries or countries where e-learning as an education system is in its adoption phase. The results suggest several important points.

Previous studies of e-learning success factors have identified perceived usefulness and usage as the two main concepts of e-learning success (DeLone & McLean, 1992). Moreover, it was found that the system quality, service quality and information quality were the three main antecedents that positively influenced these two major concepts (perceived usefulness and usage). However, these earlier studies focus almost exclusively on the technological aspect, leaving out individuals' personality traits that could also be antecedents of perceived usefulness.

The objective of this research was therefore to further study the success factors of e-learning systems, but in addition to technological factors, to shed light on individual characteristics (Aparicio et al., 2016); and I retained in this study three characteristics, namely prior knowledge, self-regulated learning and constancy of interest.

The results of my study confirm previous research findings regarding technological factors. In other words, system quality, service quality and information quality were found positively and significantly related to perceived usefulness and perceived usefulness was positively and significantly related to usage. E-learning suppliers must therefore design systems that are easy to use and simple to understand. These systems must provide high quality information like updated courses, forums, video tutorials, etc. Institutions must also provide a support system like an IT staff always available to help whenever a

problem occurs. As for governments, they should increase investments in building and upgrading e-learning systems infrastructure and maintaining a nationwide network connectivity and bandwidth.

Regarding individual characteristics, my study also revealed important points. Even though hypotheses concerning Prior knowledge, Self-regulated learning and Consistency of interest were all rejected in the model, it's important to notice that the correlations between Consistency of interest and Perceived usefulness and between Consistency of interest and Use are all positive and significant. Prior knowledge also has a significant relationship with Perceived usefulness. This result gives enough proof that individuals' factors are as important as technological factors when it comes to studying the success of e-learning systems. This is an encouragement for researchers and scholars to pay much more attention to individuals' characteristics as antecedents of the perceived usefulness of e-learning systems.

As a managerial application, e-learning system providers such as educational institutions and schools (even governments) must consider the "human" before technology. There is no point in building a high-performance, next-generation technological system that will not be used by the people for whom this system was designed. In order to avoid wasting time, money and resources, it is important to consider certain characteristics of users, including prior knowledge, self-regulated skills and perceived usefulness. Suppliers must therefore design systems that are simple to understand, giving as much instructions as possible (video tutorials, infographics, etc.).

As for governments, they must popularize the use of computers and internet from primary and secondary school, so that when people access higher education, they are already trained in the use of computers and taking online courses. Thus, prior knowledge and self-regulated learning could positively influence the perceived usefulness and use of e-learning systems.

5.4.2 Limitations and directions for future research

This study has several limitations. First, I did the study on the basis of the use of information systems in general in schools, particularly in higher education, and not on e-learning systems. In Gabon, information systems in higher education are mainly used to exchange files between teachers and students or to submit exercises or assignments; however there is not yet an e-learning system in the sense that a student who cannot find a place in a classroom could take the course from home through the e-learning system of the school. This could slightly bias the results of the study on the Use construct, because in this study it is a question of studying the influence of antecedents on the use of e-learning systems and not the use of information systems in general.

The second limitation lies in the number of educational institutions on which I conducted the study. Some schools are more advanced than others in terms of using new information and communication technologies in education. This means that the result of this study could be biased, because some students are more comfortable with the online learning system, then have a higher prior knowledge than others. What could also be considered as a limitation is the fact of having studied the success factors of e-learning systems according to the perception of users only. I think that the success of e-learning systems also depends on suppliers, in particular schools and governments, because if they do not perceive the usefulness or the urgency of implementing online learning systems, they will not invest the time and resources necessary for the creation of these systems, even if the users (students and the teachers) consider these tools as a solution or a complementary tool to the classical learning in classrooms. Future studies should also consider the perception of providers when studying the success factors of e-learning systems.

Last but not least, the data collection method (an online survey questionnaire translated from English to French, and then back to English) could be a problem. Even though I made sure the respondents understood the purpose of the study and the meaning of the questions, I still cannot tell if they've actually understood the questions. This may have caused the weakness of the data set used in the study, resulting in model fit indices very low and a little far from the recommended acceptance levels.

CHAPTER VI Research Methodology of Study II

6.1. Methodology overview: Building Process Integration BMC –TRM

The goal of this second study of my work is to provide a sustainable business model framework to successfully implement a national e-learning system for higher education in Gabon. The integration of Business Model Canvas and Technology Roadmap means establishing an effective business model canvas for the current and future situation of the company taking into account market trends and the technological evolution brought by TRM. These two strategic tools are normally developed separately but simultaneously, so that one can provide feedback to the other (Figure 6.1).

The process integration of BMC and TRM consists of 6 steps: the first step is a preparatory step to establish the objectives and the limits, then five different steps to define the business blocks of the BMC and the three levels (Market, Product and Technology) of the TRM. The main goal is to merge all of this into a single process through the five steps. This will be facilitated by the fact that team members should define specific outcomes at each stage of the process and focus on how to create a valuable product and bring it to the customer.

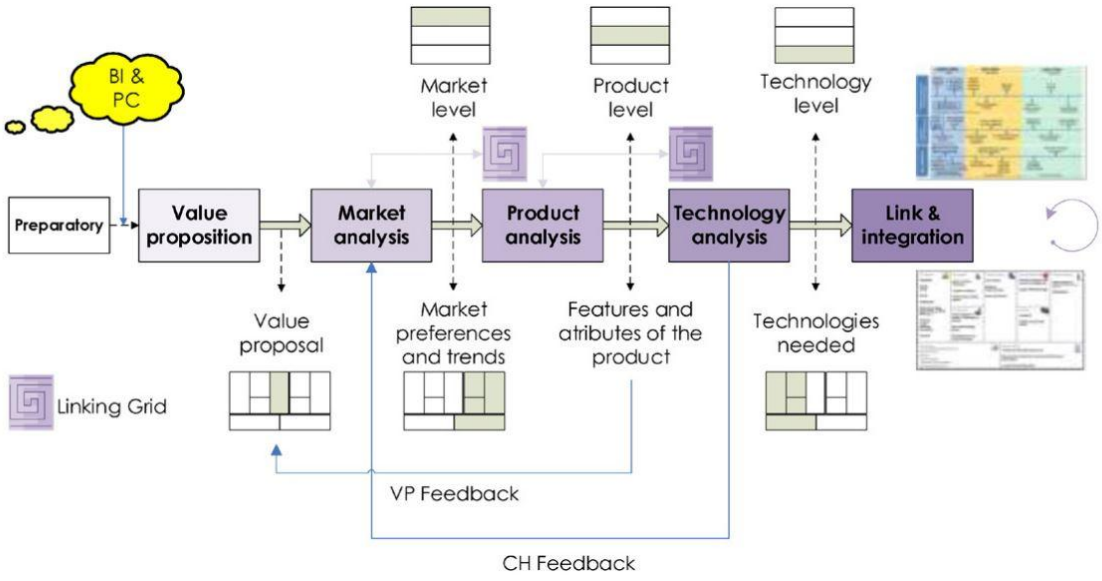


Figure 6.1: Building process integration BMC –TRM.

The research methodology is based on three main steps:

- To have a more precise idea of the key concepts (BMC and TRM) and to establish the state of the art of the integration tools; I have already carried out an in-depth literature review for each strategic tool as well as for the e-learning concept.
- The next step is to create a methodology that integrates the TRM linking and BMC integration processes into a single build process integration, starting with a business idea (BI)-product concept (PC) and continuing the BMC structure for each step of the TRM. This method was proposed by Toro-Jarrín et al. (2016) and showed interesting results.
- Finally, I illustrate a case study, SCIENTIA, in order to validate the methodology presented in the previous step. SCIENTIA is a platform that allows the management and monitoring of all school life in middle and high school in Gabon (courses, transcripts, attendance, exams, homework, report card, parental monitoring, etc.). This work could help the SCIENTIA leadership team to create and develop the same (if not better) e-learning system for higher education in Gabon.

So, to get the most out of it, it is recommended to build both at the same time, as they will be more beneficial for the managers in the end, but also during the building process, as the team is debating with two different perspectives of the process by visualizing the current and future position of the company. World famous learning platforms such as edX, Coursera, Udacity, Udemy and Codecademy were used to complete the 9 building blocks of the BMC framework and those case studies were made based on the work of Cornejo-Velazquez et al. (2020).

The TRM framework was completed based on qualitative data collected during an interview. Among the respondents of Study 1, 20 people (potential users, IT and business experts and managers from two different universities in Gabon, namely the National Institute of Sciences management and Omar Bongo University) were selected to answer a set of 20 questions (**Appendix C**), after completing the online questionnaire of Study 1. Among these 20 people only 15 were finally selected, 5 of them did not make it to the end of the interview, probably tired after having answered the online questionnaire. Based on the workshop approach, each phase of the process corresponds to a recommended workshop of four hours per day, except for the preparatory stage which can be done in less time by a few people, the owner of the business idea helped by one or two members of the team.

To facilitate the process, at each stage the team will use questions to surface specific issues and then identify which “issue” would be used to build the TRM and which to create the BMC. Team members

will answer these questions based on their own experience, research, or any available information (for questions, see **Appendix D**).

At the end of phases 2, 3 and 4, it is recommended to generate the components of the business strategy to help the team have important information to define all aspects of the action plan of the company.

Now, I am going to describe each stage in detail by establishing the purpose, inputs, expected results, specific problems and references for further research; and at the same time, to kill two birds with one stone, I will apply this analysis to my study case SCIENTIA. SCIENTIA is an educational platform built by the company Scientia Africa to help each player in the education system (from the Ministry of National Education to students, teachers and even parents of students) to monitor in real time all school activities from primary to the end of secondary school. This company operates in Gabon, Comoros and Côte d'Ivoire.

The team explored possible BIs and chose the one that represents new and unexplored activity for the business. The company was looking to reach the growing segment of higher education institutions looking to offer their students an e-learning (online learning) system to solve the problems of overcrowded classrooms, workers who need to return to school, learning where and when they want and improving the performance of students, teachers and even staff. Once all the relevant information was collected from the experts, the integration tool was used to obtain the BMC and TRM.

6.1.1 Stage 0: Preparatory phase

SCIENTIA allows, through a single software and in real time, the management of all the schooling of a student in primary and high school (courses, transcripts, attendances, homeworks, report card, parental monitoring, teachers assessment, etc.) in order to modernize schools and reduce the failure rate. In the Preparatory phase (see Figure 6.2), in order to maximize the success of this operation, only top management and selected team members based on their expertise and knowledge are allowed to participate (Osterwalder & Pigneur, 2010), as well as some potential users because having the user's opinion when creating the strategy makes the results more reliable.

This is a crucial phase because here the team must clearly define the objectives pursued (launch of a new product/business, profit growth, acquisition of new technologies, etc.) as well as the time frame of the analysis (what period corresponds short, medium and long term). Even if it's just the beginning, the team might already get an idea of what the final solution might look like by answering a few questions like where does the business want to go? Where are they now? And how can they get there?

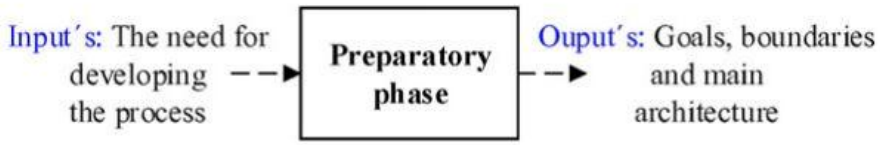


Figure 6.2: Phase 0: Preparatory phase.

Application

Given that Scientia Africa is a company of IT experts, they have a big experience in developing IT and digital solutions, especially in primary and secondary education. The objective is to explore a new solution for higher education institutions (universities, business schools, government institutes, etc.).

As it was said before, at this stage, it is crucial to define the general architecture of TRM. In this specific case, the company wants to provide a national e-learning system management platform for higher education institutions, public or private, in the mid-term (mid-term = 4 years).

This study revealed that it is important to consider that the market for online courses is growing and those e-learning platforms for higher education as an alternative product could increase sales, thus creating a new opportunity. For the product-level analysis, the company envisioned exploring new technologies for a national e-learning system that helps users access resources and knowledge without being constrained by distance, space and the time.

6.1.2 Stage 1: Value proposition identification

This phase defines BMC's value proposition after gathering useful information from team members through discussions (Figure 6.3). The team identifies whether the company's objectives in the market are to satisfy an existing demand, to bring a new product to market, to improve or to create a new offer. Osterwalder and Pigneur (2010) recommend using the storytelling technique to test the BI-PC, because by telling a story one can “introduce a new business model in an engaging and tangible way”. Choosing the right business idea is essential and sharing the vision with the target audience on how it can work could greatly increase the chances of success. This technique is used to identify potential market segments, how the business creates value, and how that value is passed on to customers.

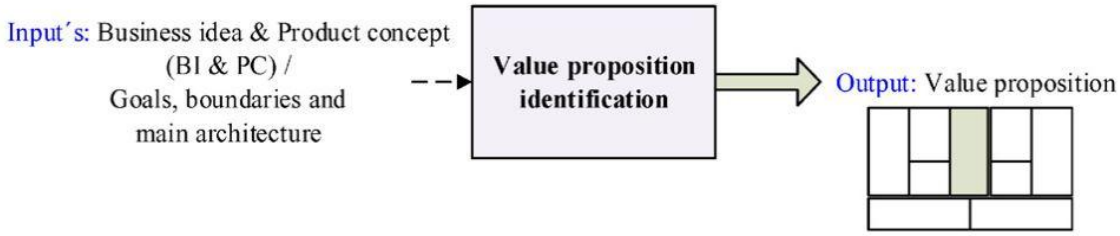


Figure 6.3: Phase 1: Value proposition identification

After that, the team can test initial ideas using Kill/Thrill sessions. This will avoid the risk of overvaluing initial ideas; the purpose of these sessions being to think about why an idea won't work (kill) and why the idea would work (thrill). These sessions are essential to "avoid the risk of overestimating the first raw ideas".

At this point the team has an idea of the potential segments, and by using the empathy map they can assess the feelings, preferences and thinking of the customers on the BI-PC. The team must consider in the process the "pain" avoided and the "gain" provided by the company's products or services.

Finally, when the team has clarified the BI-PC using storytelling, with the information available on the customer's sentiment, with the debate and analysis during the process, it is possible to clearly define the value proposition offered to the customer (Osterwalder & Pigneur, 2010).

Application

BI-PC's objective for my case study was to provide a national e-learning system in higher education that helps users access resources and knowledge without being constrained by distance, space and time for market segments different from the current business model.

Osterwalder and Pigneur (2010) proposed methods, Storytelling and Kill/thrill sessions, were used to test BI–PC; storytelling to visualize the future scenario of the product once in the market, and kill/thrill sessions to discuss important issues to consider. These methods helped the team identify the potential segments and which would be the target of the current business.

Finally, the value proposition was determined by contrasting customer feelings and expectations and what the company wants to accomplish, here it is: to offer online university courses and blended learning to combine academic oriented e-learning with face-to-face classes for enrolled university students; professional online education, job ready skills, job upgrading, quality courses and easy-to-access tools for

career changers, updated employees, instructors and businesses (Cornejo-Velazquez et al., 2020); high quality of service and support staff.

6.1.3 Stage 2: Market analysis

In this phase, the team performs a series of analyzes on the external environment of the company (see Figure 6.4), which include the following:

- *Political strategy*, which concerns the general regulations and government policies that the company must deal with. The team must analyze which government actions could pose a threat to their business versus which could increase their business profits. The team identifies environmental regulations, taxation, tariffs, intellectual property and general regulatory policy, which could pose serious barriers to entry. It is also an analysis of how government policy protects customers through product disclosure requirements, advertising regulations, product testing for safety and health checks, and price controls (Vining, Shapiro and Borges, 2005).

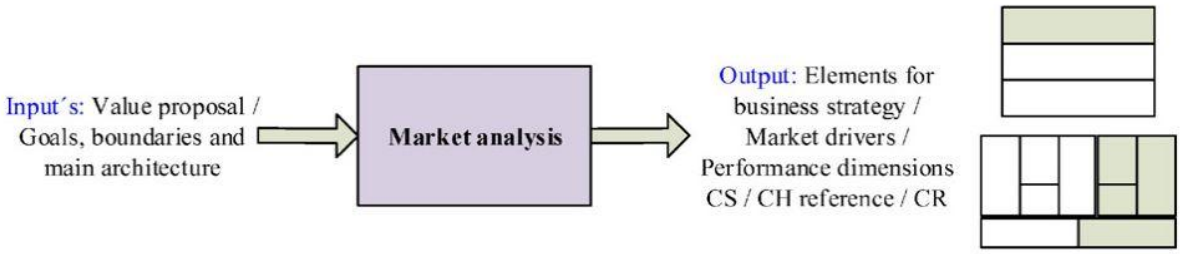


Figure 6.4: Phase 2: Market Analysis

- *Macroeconomic Forces*: The analysis focuses on the forces driving the market such as general market perception, employment rate, country GDP, structure and trends of the economy, etc.
- *Key Trends*: Societal trends, values and beliefs can influence buyer behavior and therefore affect the business model. This could be very difficult for the team because today the world is largely connected via the net and the behavior of customers is very often influenced by what is happening on the net.
- *Market Forces*: After macroeconomic forces and key trends, the team can now be aware of some critical issues affecting customer behavior. Now the company must identify the largest market segments with the greatest growth potential, and also declining ones that deserve less or no attention.

- *Industry forces*: Here come competitors and shareholders (employees, customers, government, partners, etc.). A S.W.O.T analysis (Porter, 2008) is suggested for the company to know its strengths and weaknesses as well as the opportunities and threats in the market.
- *Customer Relationship*: The questions asked here should help to acquire new customers and increase brand awareness; also shaping the strategy that creates long-term customer loyalty.
- *Business strategy*: it consists of mixing and matching all the valuable market information previously collected (key trends, threats and opportunities, industry forces, etc.) to make the company's actions successful. At this point, the team is ready to build the "Market" level for the TRM and can also complete the BMC business strategy, which must go through all the integration stages to be complete.
- *Performance dimension*: Finally, the team identifies product specifications based on market characteristics, trends and needs.

It is important to note that the team is asked to predefine the characteristics and attributes of the product/service before going through the five stages of my analysis. The reason for this is that product attributes should be identified in the value proposition phase, but later confirmed with any new information available. In order for all the information collected to be reflected in the business strategy, the BMC and the TRM are constantly reviewed.

Application

A company can hardly influence the external environment, but rather needs to adapt to changes and trends in order to develop an appropriate business strategy.

- *Political strategy*: The Gabonese government encourages the use of ICT in almost all sectors, but more particularly in higher education where schools are faced with the problem of overcrowded classrooms. To encourage the use of ICT, the government has installed fiber optic and internet infrastructure across the country. First country connected to ICT in Central and West Africa in the 2018 World Bank ranking, thanks in particular to judicious investments, Gabon has undertaken, since 2012, major local and cross-border digital projects. However, authorities are showing concern about some sensitive issues such as personal and institutional privacy, intellectual property, advertising regulation and price controls.

- *Macroeconomic forces*: With a small population of around 2 million and a GDP per capita of around $8,300, Gabon is one of the wealthiest countries in Africa, although many of its citizens are among the poorest. The economy is basically based on natural resources like oil, timber, gold, etc., and the employment rate is relatively good.

- *Key trends*: The use of new technologies is widespread and popular among the population. In education, the use of ICT is growing among schools and universities, although additional investment is needed. The recent coronavirus health crisis has prompted public and private educational institutions to pay more attention to digital solutions and to change the way of teaching and learning.

- *Market forces:* The use of ICT from primary school to university is a reality in Gabon, but more investment is needed to modernize schools, reduce the failure rate and increase employment. E-learning systems enable educational institutions to provide quality courses for students and professional training for employees who need to upgrade their skills.

- *Industry forces*: The market for online courses or e-learning platforms is still in its infancy. Schools are trying to combine classroom teaching and online teaching, but the competition is not so great. The rivalry mainly comes from outside with some world famous online learning platforms like Udemy, Coursera or edX (Cornejo-Velazquez, E., et al., 2020). My case study SCIENTIA has plenty of room to develop the new e-learning system for higher education and get a big market share in Gabon.

This methodology helped the team collect strategic information to create the best product/service for the market based on customer needs, shape future customer relationships and build a solid business strategy. With all of these elements identified, the team was able to build the TRM market level and identify the CR (customer relationship) block needed to integrate the BMC.

6.1.4 Stage 3: Product analysis

The product analysis phase (see Figure 6.5) investigates products that match market preferences, including:

- *New entrants*: New competitors entering the market should be assessed by comparing their products/services to the company's own offering, comparing the advantages/disadvantages of value propositions and customer segments.

- *Substitutes*: The team performs the same analysis for substitute products, answering questions about which products could replace theirs and how easily the customer can switch to the new offerings.

- *Product Strategy*: Considers what the product family might look like, considering key product specificities, expected price, and potential market position.

- *Identify the product*: A description of the "product brochure" including its characteristics and attributes will be the subject of the roadmap. To validate this, it is crucial to quantitatively compare product attributes with market requirements previously found.

The output of this phase is the positions in the TRM product area, the product strategy elements, and the value proposition of the features and attributes that the new product should have. Once the characteristics and attributes of the value proposition have been identified, feedback is recommended at the value proposition phase to strengthen it.

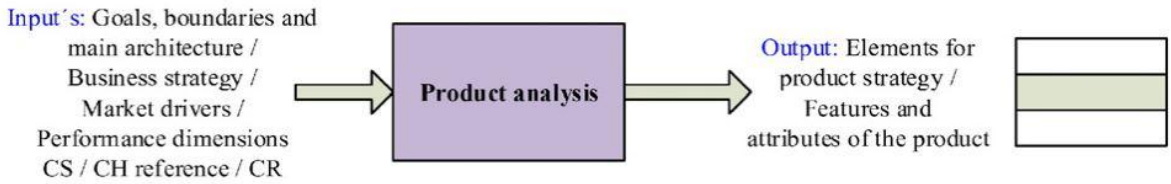


Figure 6.5: Phase 3: Product analysis

Application

To investigate which products satisfy market preferences, the team first evaluated the level of threat to new entrants and substitute products, and then identified the product portfolio for the market - product grid analysis. Next, the team developed the TRM for features that the market would appreciate, and finally, they complemented the business strategy (developed previously) with the product strategy.

The *New Entry Product Threat Assessment* highlighted the high level of threat due to the number of software development companies currently in the market, or those that may come from overseas at any time. Creating an e-learning platform for higher education is an endeavor that could be established with relatively low budgets, since the main inputs are programming languages, relatively easily accessible.

This gave an indicator of the strategy the company should adopt to secure its market share. For example, the team identified that blended learning (online learning + traditional learning) was highly valued by students. Also, they identified that what could be a powerful competitive advantage is to allow all actors in the education system (from the Ministry of National Education, universities, students, teachers, staff to parents) to follow in real time all university activities through a single unique software.

The developed tool helped the team to identify the threat level (which was considered high) for substitute products like globally known e-learning platforms (Udemy, Coursera, Youtube or edX), as customers are price sensitive, so they move easily from one product to a new product.

The workshop and discussion yielded market trends and desired product features and the team numbered the Feature Areas (FAs). They outlined product attributes that the market would appreciate and created their product brochure. After that, the team used the linking grids tool to establish product-market

relationships, which allowed the team to build the TRM product level. Once again, feedback on these features and attributes was given to improve the value proposition phase.

6.1.5 Stage 4: Technology analysis

The technology analysis phase looks for technology trends and changes that could alter the business model (see Figure 6.6). The following forces and trends are analyzed:

- *Industry forces*: The team identifies key players in the value chain and evaluates the threat level of vendors. This analysis is important in building the technology strategy.
- *Technological forces*: It is at this stage that the raw materials needed to redesign the value proposition come into play; the team describes the market, cost structure and trends of these technologies.
- *The operational and technological strategy* is defined at the end of this stage, i.e. the level of investment, the main technological fields, the technological trends, their direction, the technological alternatives, etc.
- *Key trends:* To uncover emerging technologies and adopt them in the future, the team studies what the key technology trends are and how they represent opportunities or threats.
- *Technology features:* Finally, the team evaluates the critical systems needed to produce specific functionality and attributes that match market preferences.

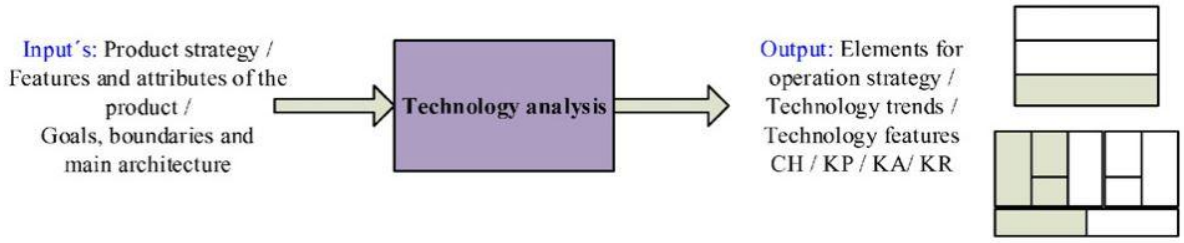


Figure 6.6: Phase 4: Technology analysis.

All the team discussions developed so far make it easy to define the Key Activities and Key Resources needed to create value. Key Partners are also identified as the team now knows who the most important stakeholders are. After running the threat analysis, the team can now identify the most

important partner to consider. KA and KR help to realize the cost structure, and details are not so important for now, an approximation of the costs is sufficient at this stage.

The technology layer for both, BMC and TRM, is filled up at this point, with the same operating strategy, making them correlated and aligned with business goals and product strategy.

Application

The main objective of this phase is to use the integration tool to find technological changes and trends that could represent an opportunity or a threat for the company.

The team identified that while vendors existed in decent numbers, they all offered almost the same portfolio. Additionally, the team recognized vendors who could provide the e-learning systems for higher education with almost the same functionality. The study made it possible to detect the importance of IT infrastructure services (Internet telecommunications network), the quality of the system (secure, well structured and easy to navigate), the quality of information (useful and reliable) and their effects mediated by the quality of service delivery (well-trained service staff) (Delone & McLean, 2003).

After that, a brainstorming was made on all the technical characteristics of the future product including services and customer support. Then, a Product-Technology Grid analysis was performed. To prioritize technologies that enhance the most market-relevant product features, the team used the integration tool. The TRM product level has been filled up, but only with the most relevant technology attributes. Finally, the team had elements to define the technological strategy.

6.1.6 Stage 5: TRM link & BMC integration

Step 5 is the final step, where all the information retrieved so far is taken into account (see Figure 6.7). For the two strategic management tools, BM and TRM, the team developed the market, product and technology levels. The next step is to link the TRM levels, using connecting grids, and to integrate the BMCs according to each time period.

The team identified all the blocks needed to integrate the business model; it is suggested to produce many possible BMCs for each time period (now, medium term and long term) with variations between blocks, models, client segments, etc., and then evaluate them. BMCs can be tested using the storytelling tool.

With all the information gathered, each formulated BMC should be more detailed. Finally, an analysis is performed to assess the alignment between the created models and the company's strategy (Pillkahn, 2008).

To stay focused on the relevant points, it's important for team members to think about the expected results at each stage; it is also to ensure that at the end of the whole process, the team will have all the blocks for BMC integration and levels for TRM linking grids. BMCs should be reviewed periodically to track changes and assess achievements and progress.

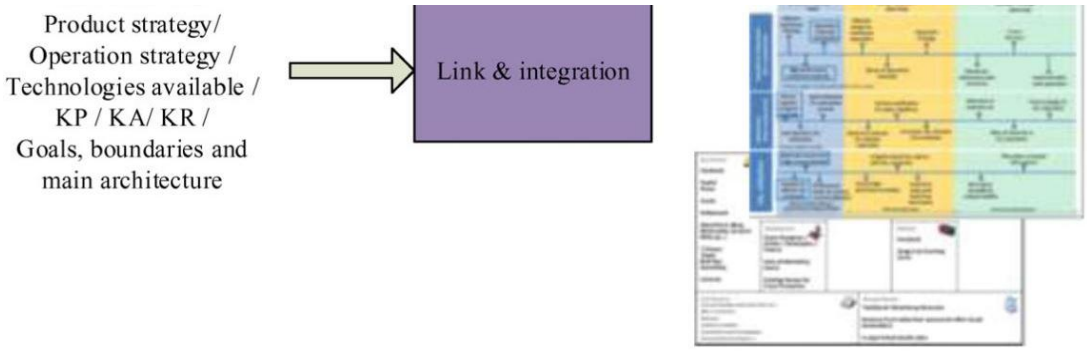


Figure 6.7: Phase 5: TRM Link & BMC integration.

Application

In this last phase, a general synthesis analysis was carried out with the aim of evaluating all 5 steps and looking for the elements that help to build a good BM. In addition, all information has been added on an empty TRM model and the paths have been identified.

6.2. Results

Figure 6.8 shows the integrated BMC for the considered case study, only for the medium-term period. It has been suggested that a BMC be developed for each period of analysis (now, medium term and long term), but in this case the team chooses a medium term period (four years) for the building integration process, and they wanted to visualize a single BM. The information collected was used in the construction of the TRM; the final product is shown in Figure 6.9.

To simplify this analysis across all phases, an automated tool can be developed with the aim of helping the management team know the next topics to be treated and have the description of all the questions for each phase; after the team has answered all those questions, it builds the two tools following the methodology described above.

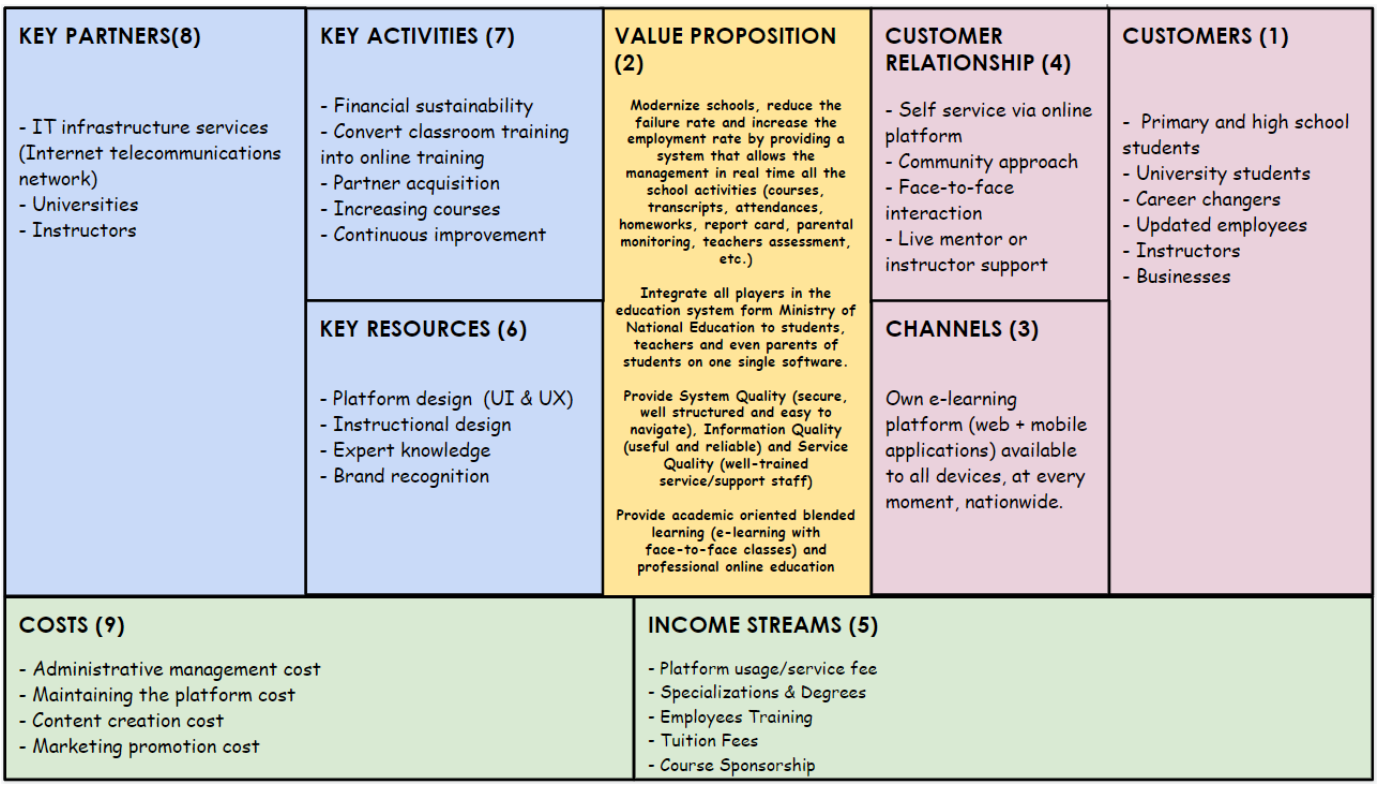
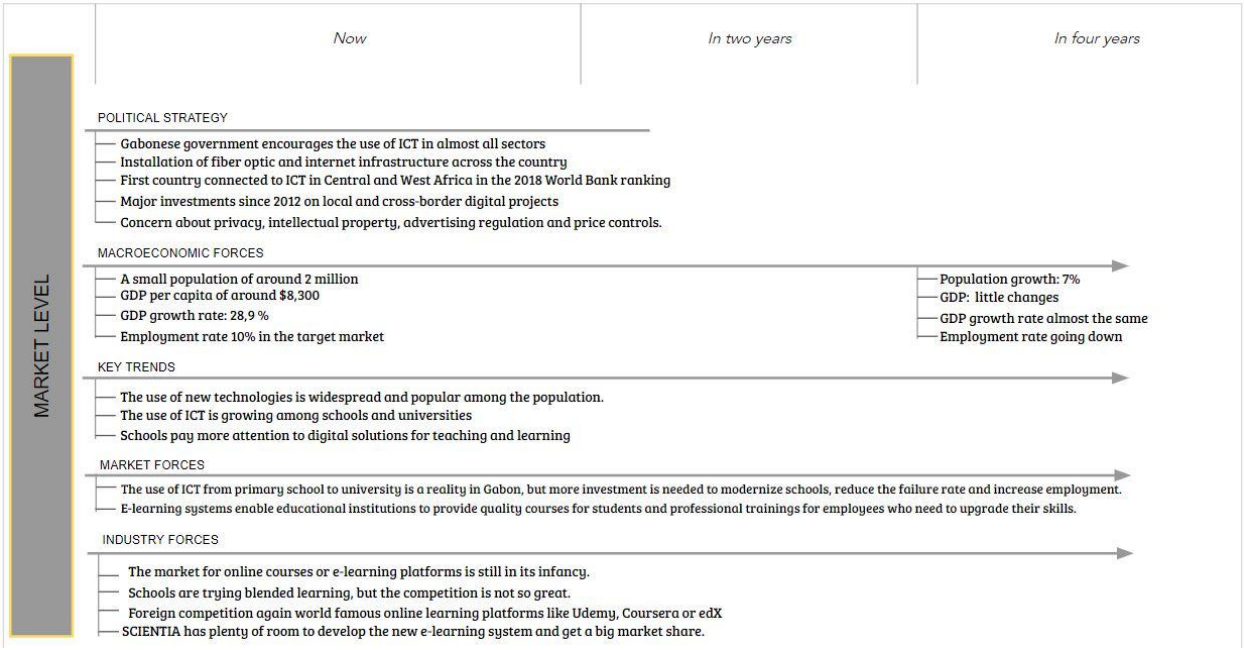
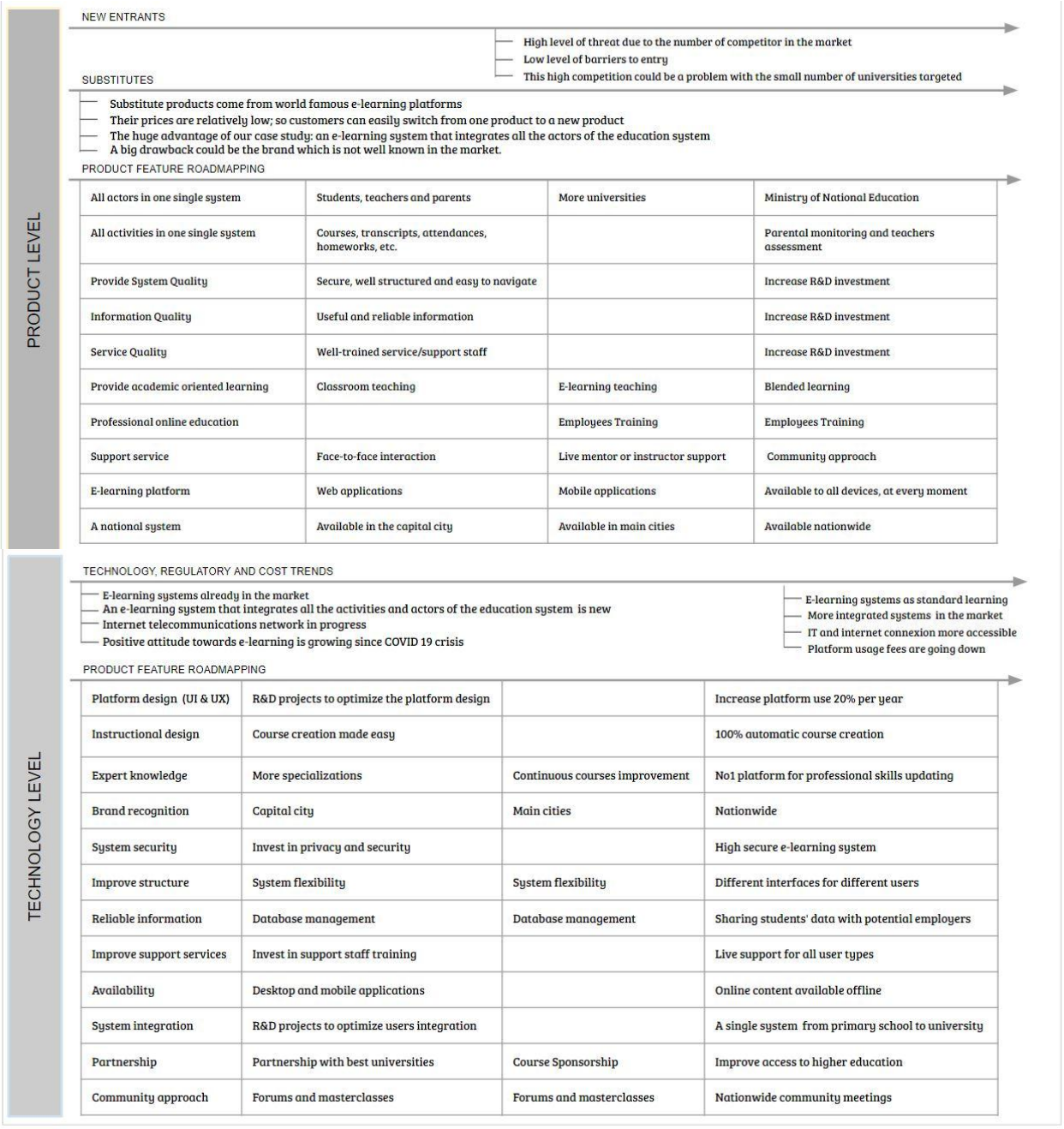


Figure 6.8: BMC for the case study

Figure 6.9: Final TRM for the case study





6.3. Conclusion and implications

Building process integration has proven that the power of the two strategic management tools (BMC and TRM) can be multiplied by taking the advantages of each tool and producing two strategically aligned products. Additionally, the methodology was applied by obtaining key insights from a team of business experts and potential customers. This strategic information has been transformed to obtain a business model that adapts to different periods of time, in order to achieve short, medium and long term

objectives. I conclude by saying that, with the building process integration tool, the time perspective of the TRM made it possible to complete the BMC.

The main results of this research confirm that the integration of BMC and TRM helps to increase the chances of finding funds to sponsor R&D in innovative planning for engineers and researchers; and this has already been affirmed by previous studies (Abe, Shinokura, Suzuki, Kubo, & Sakuma, 2006; de Reuver, Bouwman, & Haaker, 2013). As an academic contribution, this study lends more credence to the importance of research on the two management tools in creating business strategy.

The link grid tool was used to improve the connection between the levels and, thus, helped to develop strongly linked TRM levels. As a managerial involvement, it will help business leaders to focus R&D efforts only on product features that would satisfy market expectations.

The case study provided more insight about how to address strategic issues using a systematic guide that allows different perspectives. Additionally, this methodology has shown that having a clear business need contributes to a successful roadmap. One of the most important benefits of the building process integration tool is that it has created a BM for the current situation and also for the future (medium and long term); this would give businesses insight into what the business could change based on the requirements. At the same time, market, product and technology strategies have been developed, taking into account the needs of business administration.

No matter how strong the business strategy is, the success of the two strategic management tools must only be tested once the business is up and running.

6.4. Future research

Even if this study showed that the integration of BMC and TRM makes it possible to build a sustainable business model for the current situation and in the medium and long term, the limit remains in the fact that this method focuses mainly, if not only, on the economic aspect of the business model.

Joyce and Paquin (2016) proposed the Triple Layered Business Model Canvas (TLBMC) as a tool to explore the innovation of sustainability-oriented business models. Based on the original business model canvas of Osterwalder and Pigneur (2010), the TLBMC explores two additional layers: an environmental layer based on a life cycle perspective and a social layer based on a stakeholder perspective. When applied together, the three layers make more explicit the multiple types of value generated by the business. I suggest further investigation in this direction.

CHAPTER VII Conclusion and Future Research Directions

7.1. Research Summary and Conclusion

Online learning systems are increasingly crucial in universities, schools, government institutions and other organizations that provide education or training services. The objective of setting up e-learning systems is to allow as many people as possible to access educational services through electronic channels without being limited in time and space. Indeed, online learning or e-learning is increasingly seen as a cheaper and more flexible alternative to traditional school, as it helps to increase the number of people with access to higher education, particularly in developing countries or marginalized groups in rural areas. In some developing countries like Gabon, where I conducted the research, higher education faces great challenges such as an insufficient number of teachers and facilities, limited seating in classrooms and outdated course content. E-learning systems are constantly mentioned as a solution to traditional learning encountering these problems. Therefore, the need to study the determinants of the effectiveness of e-learning systems, both managerially and academically, is growing.

The Gabonese authorities have made a lot of effort in the development of e-Government (online services for citizens, companies and public institutions) and consider the development of ICT and e-learning systems as an effective and sustainable solution to the many problems encountered in universities, including the low number of teachers and educational structures as well as overcrowded classrooms. However, it is easy to see that many people still prefer traditional classroom learning to online learning systems, not only for technological reasons, but also for some reasons related to their individual characteristics. Furthermore, although many universities now recognize the benefits of e-learning systems, many are still undecided to actually invest in installing these systems; those who tried to invest huge sums of money in e-learning projects did not always get a good return on investment.

Therefore, adopting e-learning technology as an educational system without planning can be very costly in terms of resources (skills, time, money and energy). Thus, the purpose of my research was to study the success factors of the implementation of online learning systems, both on the side of users (students, teachers and technical staff) and on the side of providers (universities and government institutions). To be able to achieve the two main objectives of my work, I decided for more efficiency to divide the work into two major studies.

Conclusion Study 1

Since the success of e-learning systems is almost always attributed to technology, the literature review revealed the need to pay more attention to the characteristics of individuals as determinants of e-learning systems success. This study therefore allowed me to answer the following questions:

- What factors affect perceived usefulness and use for the effectiveness of e-learning systems?

- Do individual characteristics such as prior knowledge (PK), self-regulated learning (SRL) and consistency of interests (CI) play a significant antecedent role for the dependent factors (perceived usefulness and use) in the proposed model?

An online survey questionnaire developed based on the literature review was used to collect data from around 500 respondents (students, teachers and technical staff in some universities in Gabon); then statistical calculations were performed for reliability and validity verification, correlation analysis and hypothesis testing.

The results confirm the conclusions of DeLone & McLean (2002) regarding technological factors. In other words, system quality, information quality and service quality were positively and significantly related to perceived usefulness and perceived usefulness had a significant positive relationship with Use. (H_1, H_2, H_3 and H_7 are supported). Regarding individuals' characteristics, even though hypotheses concerning Prior Knowledge, Self-regulated Learning and Consistency of Interest on the endogenous construct Perceived usefulness (H_4, H_5 and H_6) were all not supported, it is important to notice individuals' factors like Prior Knowledge and Consistency of Interest had significant correlations with Perceived usefulness and Use. This result sufficiently proves that individual factors are as important as technological factors when it comes to studying the success of e-learning systems. This is an encouragement for researchers and scholars to pay much more attention to individuals' characteristics (motivation, age, gender, social support, etc.) as antecedents of the perceived usefulness and use of e-learning systems.

Conclusion Study 2

Any business or institution that plans to successfully implement a long-term sustainable e-learning system must have an effective strategy in place to avoid disappointment and waste of resources. The objective of this second study was to investigate the frameworks for creating a successful e-learning business model for a good return on investment. Thus the objectives were (1) to contribute to the search

for the most efficient business models in the field of e-learning, (2) to generate a business model framework using the Business Model Canvas (BMC) and Technology Roadmap tools (TRM) and (3) combine these two management tools and apply them on an e-learning case study to create a sustainable business model for effective implementation of e-learning in higher education in Gabon.

Based on previous studies, an institution's readiness to adopt e-learning as an education system is measured in terms of technical, content, human and financial resources. This study therefore allowed me to answer the following questions:

- What commercial strategies should be considered to ensure the pedagogical, technological, human and financial success of e-learning systems?

- How to integrate the Business Model Canvas (BMC) and Technology Roadmap (TRM) tools to provide a sustainable business model aligned with current and future business needs?

A case study based on a literature review helped me complete the 9 building blocks of the business model canvas using popular online learning platforms such as edX, Coursera, Udacity, Udemy and Codecademy, which helped me to obtain more specific information and knowledge through an interview with a group of potential users and computer and business experts from two different universities in Gabon, namely the National Institute of Management Sciences and Omar Bongo University. BMC and TRM were developed separately but simultaneously, then linked to establish an effective business model canvas for the current and future state of the business.

The results show the integrated BMC for the considered case study SCIENTIA, only for the mid-term period. Although it was suggested that the BMC be developed for each period of analysis (now, medium term and long term), in this case the team chose a medium term period (four years) for building process integration, and they wanted to visualize a single BMC. The information gathered was used in the construction of the TRM and the final product was presented.

7.2. Research contributions

The major contribution of this research is to develop a conceptual framework on the success factors for the implementation of e-learning systems by combining technological and individual factors as suggested by previous studies. Annika and Å ke (2009) argue that “research can help not only by further researching individual factors but also, and in particular, by understanding combinations of factors”. This is a contribution to the application as the framework can be used as a checklist of factors to consider when designing and implementing e-learning systems in universities.

Regarding the field of e-learning, it is difficult, with some exceptions of course, to find quality articles or reports from many developing countries, because e-learning in developing countries is still in its infancy. Thus, this research contributes to the literature on the success factors of the implementation of e-learning systems in developing countries in general and in Gabon in particular; there is much more research on e-learning in developed countries.

As a result of the research, three key contributions were made, namely confirming the technological factors necessary for the success of an effective e-learning system, identifying the characteristics of individuals affecting perceived usefulness and use for e-learning efficiency and developing a sustainable business model for e-learning systems. This research confirmed the importance of technological factors (system quality, information quality and service quality) in evaluating the success of e-learning systems. Thus, successful implementation of e-learning systems in higher education requires organizations to create learning systems that are accessible, reliable, useful, and easy to use. These systems should be user-friendly, interactive, and accessible with attractive features; reliability, responsiveness and user support are also essential.

This research recognized the importance of individuals' characteristics in the successful acceptance of online learning systems. There's no point in building high-performance, next-generation technology systems if people aren't using them. Since Prior knowledge has been found to be correlated to Use, private and public schools should popularize the use of computers from primary and secondary school, so that when people reach higher education, they are already qualified to use computers and take online courses. Thus, their prior knowledge and self-regulated learning might have a more positive influence on their perceived usefulness and use of e-learning systems. The government should promote the use of ICT in primary and secondary education so that once at university, students trust and are more open to online learning systems. Providers of e-learning systems such as educational institutions and universities (even governments) need to consider “people” before technology. They should seek the participation of users (student, teachers, etc.) when building these systems.

As a managerial involvement, companies must give more and more importance to e-learning. First on the recruiting side, recruiters should give the same importance to people who have graduated or obtained their degree via online learning platforms (like Coursera or edX) as to those who have obtained their degree in taking courses in a classroom at the university. Secondly, these companies must also promote e-learning systems to their employees, to enable them to improve their skills, acquire new skills or even change careers.

The case study in Study 2 provided more information on how to approach strategic issues using a systematic guide that allows for different perspectives. Additionally, this methodology has shown that having a clear business need contributes to a successful roadmap. One of the most important advantages of the construction process integration tool is that it has created a business model for the current situation and also for the future (medium and long term); this would give businesses insight into what the business could change based on requirements. At the same time, market, product and technology strategies were developed, taking into account the needs of business administration. No matter how strong the business strategy is, the success of both strategic management tools should only be tested once the business is up and running. If this e-learning business model is successfully implemented in Gabon (a developing country), this will probably inspire other developing countries in Africa or even in the world.

7.3. Limitations and future research

This research has several limitations. One of them concerns outdated information concerning the Gabonese education system. The information used in this research is somewhat old (1993 - 2003). New information is needed, because since then a lot has changed rapidly in the world in general and also in Gabon in particular regarding the use of ICT in schools. Another main limitation of this research was the lack of time available to conduct the two studies. Instead of doing one data collection after another, I collected data from Study 1 and Study 2 at the same time. As the data collection was done mostly online and also due to the means available, it was a bit difficult to bring together the same people for two different studies. Also, even if before starting I explained to the respondents the ins and outs of the research, the data collection being online I am not able to know if the participants were able to understand all the questions. This may explain the weakness of the data set used in this research.

The third limitation is the fact that I carried out study 1 based essentially on the use of information systems in general in higher education, but not on e-learning systems. In Gabon, information systems in higher education are mainly used to exchange files between teachers and students or to submit exercises and assignments; however, there are very few e-learning systems in the sense that a student who cannot find a place in a classroom can take the same course from home through the university's e-learning system. This could slightly bias the results of the study on the Use construct, because this study is about studying the antecedents on the use of e-learning systems and not the use of information systems in general. Another limitation lies in the number of universities on which I conducted the study; some are

more advanced than others in terms of using ICT in their education systems. This means that the result of this study could be biased, as some students are more comfortable with the online learning system than others.

A limitation of study 1 was the fact of having studied the success factors of e-learning systems according to the perception of users (students, teachers, IT specialists) only. But this was corrected in study 2 by studying the success factors of e-learning systems according to providers (universities and government institutions). If organizations do not perceive the usefulness or urgency of setting up e-learning systems, they will not invest the time and resources needed to create these systems, even if users consider these tools as a solution or a complementary tool to traditional classroom learning. Even if study 2 showed that the integration of BMC and TRM makes it possible to build a sustainable business model for the current situation, as well as in the medium and long term, the limit remains in the fact that this method focuses mainly, if not only, on the economic aspect of the business model canvas.

Study 1 investigated the success factors of implementing e-learning systems by combining technological factors and people's characteristics. It was confirmed that the variables of the study had a strong correlation between them, so I think that it is difficult to determine which variables (technology vs characteristics of the individuals) influenced the judgment of the respondents the most. Since the literature is full of studies on technological factors, future research could study the success factors of e-learning systems with only the characteristics of individuals. Results may be different. This research chose prior knowledge, self-regulated learning, and consistency of interests as individual factors. Future studies can address other individuals' characteristics like motivation, conflicting priorities (not enough time to learn), social support, age, gender, etc.

The next time similar research should be conducted, it should be conducted in universities with the same level of ICT development, where all respondents have almost the same level of technological confidence, have computer skills and feel comfortable using computers. Lack of experience with computers may discourage participants from completing questionnaires. As future research, I can also try to find out employers' perception of online graduates. A study with human resources managers of companies as a sample could help me to assess the level of importance (or trust) given to e-learning systems by comparing the number of employees who have graduated online compared to the total number of employees.

The Triple Layered Business Model Canvas (TLBMC) proposed by Joyce and Paquin (2016) may be the subject of future research. Based on the original business model canvas of Osterwalder and Pigneur (2010), the TLBMC considers two extra layers: an environmental layer based on a life cycle perspective

and a social layer based on a stakeholder perspective. When used together, the three layers make more clear the multiple types of value generated by the business. Furthermore, future studies could explore each block of the Business Model Canvas in more depth to strengthen the literature on the business model of e-learning systems.

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Appendix A: Abstract in Korean

정보통신기술(ICT)이 전 세계적으로 사회에 통합되면서, 그 영향은 사람들의 삶과 국가 경제에 명확하게 나타나고 있다. 가봉과 같은 개발도상국에서 ICT 의 활용은 모든 분야에서 많은 문제를 극복하기 위한 필수 요소로 간주된다. 특히 교육 분야에서의 필요성이 더욱 크다. 교육 분야에서 ICT 를 활용한 것을 " e-learning"이라고 부르며, 이는 전자 매체를 사용하여 교육 프로그램에 원격으로 접근하고 전통적인 교실 환경 없이 가르치고 배우는 것을 의미한다. 가봉의 고등 교육 분야에서는 교사와 시설 부족, 교실 수용인원 한정, 오래된 강의 콘텐츠 등 많은 문제에 직면하고 있으며, 이를 해결하기 위해 전자 학습 시스템(e-learning systems)이 지속적으로 언급되고 있다. 하지만 실제 계획 없이 전자 학습 기술(e-learning technology)을 교육 시스템으로 채택하는 것은 기술, 시간, 자금 및 에너지 등 자원 측면에서 매우 비용이 많이 들 수 있다. 따라서 우리 연구의 목표는 사용자(학생, 교사, 기술 직원)의 측면에서의 전자 학습 시스템의 성공 요인과 제공자(대학 및 정부 기관)의 측면에서의 성공 요인을 연구하는 것이다. 연구 1 에서는 사용자의 측면에서, 연구 2 에서는 제공자의 측면에서의 전자 학습 시스템의 성공 요인을 조사하는 것이다.

전자 학습 시스템의 성공은 거의 항상 기술과 연관되어 있다고 여겨지기 때문에, 연구 1 은 기술적 요인(시스템 품질, 정보 품질, 서비스 품질)과 개인의 특성 요인(기존 지식, 자기 조절 학습, 관심 일관성)을 이전 연구에서 제안된 것을 기반으로 두 요인을 결합하여 전자 학습 시스템의 인지된 유용성(perceived usefulness)과 사용(Use)에 영향을 미치는 요인을 분석하는 것을 목표로 한다. 연구에서는 단일 방법론 접근, 양적 방법론 및 구조화된 설문 조사 질문지를 사용하여 가봉의 몇몇 대학의 학생, 교사, 기술 직원 등 약 500 명의 응답자로부터 데이터를 수집하였다. 수집된 데이터는 구조 방정식 모델링(SEM)을 사용하여 분석되었고, 결과는 모델의 변수와 요인들 간에 유의한 관계가 있는 것으로 나타났다.

연구의 결과와 결론은 기술적 요인들이 인지된 유용성과 사용에 미치는 영향을 확인하고, 개인의 특성이 전자 학습 시스템의 성공에 중요한 역할을 한다는 것을 밝혀냈다. 향후 연구에서는 연구자들이 개인의 특성에 더욱 주의를 기울일 필요가 있는 것으로 사료된다. 전자 학습 시스템의 성공은 기술적,

콘텐츠, 인적, 재정적 자원의 관점에서 지속 가능한 사업 계획과 조직적인 준비에 의존한다. 따라서 연구 2 에서는 비즈니스 모델 캔버스(BMC)와 기술 로드맵(TRM) 도구를 결합하여 투자 수익률이 좋은 성공적인 전자 학습 비즈니스 모델(e-learning business model)을 만들기 위한 프레임워크를 조사하는 것을 목표로 한다. edX, Coursera, Udacity 와 같은 인기 있는 전자 학습 플랫폼을 활용한 문헌 기반의 사례 연구를 통해, 가봉의 두 대학의 잠재적 사용자와 비즈니스 전문가로 구성된 패널과의 인터뷰를 통해 더 구체적인 통찰력을 얻을 수 있었다. BMC 와 TRM 은 별도로 개발되었지만 동시에 진행되었으며, 그 후 연결하여 고려된 SCIENTIA 사례 연구에 적용하였다. BMC 는 중기적 기간(4 년)을 위해 개발되었으며, 수집된 정보는 TRM 의 구축에 활용되었으며 최종 결과물이 제시되었다. 연구의 결론은 두 연구의 결과를 기반으로 하며, 기여, 한계 및 향후 권고 사항에서 자세히 논의되었다.

키워드: 전자 학습 시스템, 전자 학습 시스템의 성공, 전자 학습 시스템 비즈니스 모델 프레임워크, 인지된 유용성, 비즈니스 모델 캔버스, 기술 로드맵

Appendix B: Study 1 questionnaire

The original questionnaire was developed using google forms, in English, then translated into French, and then translated back into English because the respondents did not speak English, French being their first language.

Section 1 / 11

Can e-learning improve access to higher education in Gabon?

Classrooms in higher education in Gabon are overcrowded and access to education is increasingly expensive. With an increasingly large and more educated population, there is an urgent need to build an effective system that improves access to higher education (financially and in terms of infrastructure).

This questionnaire will allow us to study the perception of e-learning users, in particular students and teachers, vis-à-vis the establishment of an e-learning system but especially its use in the Gabonese context.

Thank you for your contribution to the evolution of higher education in Gabon.

Section 2 / 11 - Demographic data

1. Your gender
   - ◯ Female
   - Male

2. Your age range
   - ◯ Under 18 years old
   - ◯ 18 years old - 29 years old
   - ◯ 30 years old - 44 years old
   - ◯ 45 years old - 54 years old
   - ◯ 55 years old and more

3. Your highest level of education
   - ◯ Baccalaureate
   - ◯ License (Bachelor)
   - ◯ Master
   - ◯ Doctorate
   - ◯ Professor
   - Other:

4. Employment status
   - ◯ Student
   - ◯ Teacher
   - ◯ Other:

5. Choose your university
   - ◯ Omar Bongo University
   - ◯ University of Science and Technology of Masuku
   - ◯ National Institute of Management Sciences
   - ◯ Other:

Section 3 / 11 - **Quality of the e-learning system**

6. Evaluate the quality of your e-learning system

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The e-learning system is easy to navigate (SysQ1)					
The e-learning system allows me to find easily the information I'm looking for (SysQ2)					
The e-learning system is well structured (SysQ3)					
The e-learning system is easy to use (SysQ4)					

Section 4 / 11 - **Information Quality**

7. Evaluate the quality of information in your e-learning system

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The information provided by e-learning system is useful (IQ1)					
The information provided by e-learning system is understandable (IQ2)					
The information provided by e-learning system is interesting (IQ3)					

The information provided by e-learning system is reliable (IQ4)					

Section 5 / 11 - **Service quality**

8. Evaluate the service quality of your e-learning system

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The responsible service personnel is always highly willing to help whenever I need support with the e-learning system (SerQ1)					
The responsible service personnel provides personal attention when I experience problems with the e-learning system (SerQ2)					
The responsible service personnel provides services related to the e-learning system at the promised time (SerQ3)					
The responsible service personnel has sufficient knowledge to answer my questions in respect of the the e-learning system (SerQ4)					

Section 6 / 11 - **Prior knowledge**

9. Your online learning experience

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I have already taken online courses in the past (PK1)					
I have taken online courses for a long period of time in the past (PK2)					
I have graduated by taking online courses in the past (PK3)					

Section 7 / 11 - **Self-regulated learning**

10. Assess your ability to self-regulate your learning

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Self-evaluating: I'm able to evaluate the quality or progress of my exercises and homeworks (SRL1)					
Organizing and transforming: I make an outline before starting my work (SRL2)					
Setting goals and planning: I start studying two weeks before exams, and I pace myself (SRL3)					
Seeking information: I use online knowledge bases to assist in further understanding of my courses and exercises (SRL4)					

Section 8 / 11 - **Grit (Consistency of Interest)**

11. Assess your persistence in taking an online course (training) over several months

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I often set a goal but later choose to pursue a different one (CI1)					
I have been obsessed with a certain idea or project for a short time but later lost interest (CI2)					
I have difficulty maintaining my focus on projects that take more than a few months to complete (CI3)					

Section 9 / 11 - **Perceived usefulness of e-learning**

12. Assessment of your perception of the e-learning system

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Accomplish quickly: using the e-learning system in my study enables me to accomplish my tasks more quickly (PU1)					
Improving performance: using the e-learning system improves my study performance (PU2)					
Increasing productivity: using the e-learning system in my study increases my productivity (PU3)					
Easier study: using the e-learning system makes it easier to do my study (PU4)					
Overall usefulness: overall, I find the e-learning system useful to my study (PU5)					

Section 10 / 11 - Use of the e-learning system

13. You use the e-learning system to:

	not at all	less than once a week	about once a week	2 or 3 times a week	4 or 6 times a week	about once a day	several times a day
Retrieve information (Use1)							
Publish information (Use2)							
Communicate with colleagues and teachers (Use3)							
Store and share documents (Use4)							

Execute course work (Use5)	◯	◯	◯	◯	◯	◯	◯

Section 11 / 11 - **Individual Impact**

14. Assess the impact that online learning has on you

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The e-learning system enables me to accomplish tasks more quickly (II1)					
The e-learning system increases my productivity (II2)					
The e-learning system makes it easier to accomplish tasks (II3)					
The e-learning system is useful for my job (II4)					

Appendix C: Study 2 qualitative data collection

Preparatory phase
- What are the critical goals? - What issues are important to address? - What are likely to be the most interesting and important topics? - Why do we need to act?
Value proposition
- What is offered to the client? (e-learning systems users) - What is the client expecting to receive? - Formulate the value proposal - What are the objectives pursued?
Market analysis
- What are the government policies concerning e-learning? - Key issues, entry barriers, incumbent competitors and their relative strength - Major societal trends that may influence your e-learning business model - Major market segments, their attractiveness, and spotting new segments
Product analysis
- Identify the product and the new entrants in your market? - How are they different? What competitive advantages or disadvantages do they have? - Which products or services could replace yours? - How easy is it for customers to switch to these substitutes?
Technology analysis
- What technologies represent important opportunities or disruptive threats? - Identify the critical system requirements and their targets - Specify the major technology areas and technological drivers and their targets - Recommend the technology alternatives that should be pursued

Appendix D: Issues that the team goes through the building process integration.

	Issues	References
Preparatory	- What are the critical goals? - What issues are important to address? - What are likely to be the most interesting and important topics? - What might the outputs look like? Will these meet the aims? - Where do we want to go? - Where are we now? - How can we get there? - Why do we need to act?	Fast-start Roadmapping Workshop Approaches (Phaal R., Farrukh, Mitchell, & Probert, 2003)/Mobilize (BMC). Framing the project goals, planning the project, and assembling the team (Osterwalder & Pigneur, 2010)
Preparatory	- What should we do? - How should we do it? - Named and describe the expertise of the team's members	
Value proposition	- Describe the BI–PC - Objectives pursued? - Test preliminary BI–PC - Brainstorming the possible customer segments - Empathy map - What is offered to the client? (My will) - What is the client expecting to receive? (My vision) - Formulate the value proposal	Mobilize (BMC). Testing preliminary ideas/Understanding (BMC). Developing a good understanding of the context in which the business model will involve (Osterwalder & Pigneur, 2010)
Market analysis	- Rivalry and government policy - Entry barriers and government policy - Substitutes and government policy - Suppliers and government policy - Buyers and government policy - Current overall conditions from a macroeconomics perspective - Current capital market conditions as they relate to your capital needs - Economic infrastructure of the market in which your business operates - Major societal trends that may influence your business model - Major socioeconomics trends relevant to your business model - Key issues and transforming your market from customer and offer perspectives - Major market segments, their attractiveness, and spotting new segments - Incumbent competitors and their relative strength - Market needs and analysis how well they are served - Elements related to customers switching business to competitors - Performance dimension (Define the performance dimension: characteristics the - Which barriers must they overcome? - What is their value proposition? - Which customer segments are they focused on? - Which products or services could replace ours? - How much do they cost compared with ours? - How easy is for customers to switch to these substitutes? - What business model tradition do these substitute products stem from? - Identify the product	Building the firm's political strategy (5F's Porter) (Vining, Shapiro, & Borges, 2005)/(BMC) Strategy; macroeconomics forces, key trends, market forces, industry forces (Osterwalder & Pigneur, 2010)/Fast start roadmapping workshop approach (Phaal R., Farrukh, Mitchell, & Probert, 2003)/T – Plan (Phaal et al., 2004a) roadmapping at the firm level (Moehrle, Isenmann, & Phaal, 2013)
Technology analysis	- What are the major technology trends both inside and outside your market? - What technologies represent important opportunities or disruptive threats? - What emerging technologies are peripheral customers adopting? - What regulatory trend influences your market? - What rules may affect your business model? - Which regulations and taxes affect customer demand? - Who are the key players in your industry value chain? - To what extend does your business model depend on other players? - Are peripheral players emerging? - Identify the critical system requirements and their targets - Specify the major technology areas - Specify the technological drivers and their targets - Identify technological alternatives and their time lines - Recommend the technology alternatives that should be pursued	(BMC) Strategy, key trends, industry forces, macroeconomic forces (Osterwalder & Pigneur, 2010)/Building the firm's political strategy (5F's Porter) (Vining, Shapiro, & Borges, 2005)/Fast start (Moehrle, Isenmann, & Phaal, 2013)
Link & integration	- Linking the three levels, market, product and technology; find gaps and look for future actions - Creation (Prototyping potential BM for exploring different direction for the final BM. Change the blocks could give an opportunity to explore new ideas or a totally different BM. Test preliminary BM. Storytelling. Select which of the potential BM are more suitable with the strategic align)	T – Plan (Phaal R., Farrukh, Mitchell, & Probert, 2003)-/Technology management and roadmapping at the firm level (Moehrle, Isenmann, & Phaal, 2013)/(BMC) creation, design (Osterwalder & Pigneur, 2010)