



OPPORTUNITIES AND DEVELOPMENT OF E-HEALTH IN AFRICA: GABON CASE

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Abstract

E-Health is a modern tool that permits to collect, analyzes, manage and share health information in better way in order of healthcare services improvement. The fact that e-Health is attracted and widely used in developed countries showing that it is offering suitable, sustainable and challenging solutions to health system by ensuring the benefits of using ICT technologies. From this point of view, it now appears that African countries may also fruitful experience e-Health in the goal to improve the quality of their health services. This paper discusses the main opportunities and development of e-Health for African countries based on its components and strategies. Gabon, a central African country, was chosen as a sample country where the main challenges of e-Health were investigated. Considering the whole health issues in Gabon these innovative health solutions can also be profitable by establishing legal frameworks and functional strategies in the purpose of providing financially affordable, reliable and more effective healthcare services. From this regards, because much endeavors remain to be done in the field of healthcare provisions, government as policy maker should be more active in taking actions for use of these IT technologies.

Keywords: ICT, e-Health System, Public Health

AFRİKA'DA E-SAĞLIĞIN GELİŞİMİ VE FIRSATLAR: GABON ÖRNEĞİ

Öz

E-Sağlık, sağlık hizmetleri iyileştirme amacıyla sağlık bilgilerini daha iyi bir şekilde toplamaya, analiz etmeye, yönetmeye ve paylaşmaya olanak tanıyan modern bir araçtır. BİT teknolojilerinin sunduğu, sağlık sistemine uygun, sürdürülebilir ve zorlu çözümler gelişmiş ülkelerde e-Sağlık alanının ilgi çekmesi ve yaygınlaşması sonucunu doğurmuştur. Bu açıdan bakıldığında, Afrika ülkelerinin sağlık hizmetlerinin kalitesini iyileştirme hedefinde e-Sağlık uygulamalarını verimli bir şekilde deneyimleyebilecekleri görülmektedir. Bu makalede, Afrika ülkeleri için e-Sağlık uygulamalarının temel bileşenleri, stratejileri, fırsatları ve gelişimi ele alınmaktadır. Çalışmada, pilot olarak merkezi bir Afrika ülkesi olan Gabon seçilmiştir. Gabon'daki tüm sağlık konularını göz önüne alan bu yenilikçi sağlık çözümleri, mali açıdan uygun maliyetli, güvenilir ve daha etkili sağlık hizmetleri sunmak amacıyla yasal çerçeve ve fonksiyonel stratejiler oluşturarak başarılabilir. Bu bağlamda, sağlık hizmetleri alanında birçok çaba sarf edilmesi gerektiği için, politika yapıcı olarak hükümet bu BT teknolojilerinin kullanımı için daha aktif hareket etmelidir.

Anahtar Kelimeler: BİT, e-Sağlık sistemi, Halk Sağlığı

1 Introduction

E-Health is defined as the use of information and communication technologies (ICTs) for health. It includes the treating of patients, conducting research, educating health workforce, tracking diseases and monitoring public health [1]. E-Health is divided then, into three major areas such as "Electronic health record" focused on the storing, managing and transmission of data. The second one is related to "e-Prescribing" referring to clinical information system consisting for clinicians especially to make their decision and then to communicate the suitable medication prescriptions to their patients. The last one is "Smart Home" allowing simplifying health care services from a distance [2]. It is used for specific residence equipped with technology that allows monitoring and then provides independence and the maintenance of good health towards patients.

According to World Health Organization (WHO) this concept is defined as "the cost-effective and secured use ICT in support of health and health-related fields, including healthcare services, health surveillance, health literature, health education,

knowledge and research" [3]. In other words, it takes into account the main aspects of health by using modern technologies in the goal to improve health-care services.

By this regards, ICTs continue to develop tools, services and knowledge for healthcare workers in order to transform traditional healthcare into the revolutionary e-Health. Today, e-Health represents a huge social and economic stage in developed countries and soon in developing countries. With the development of technologies, e-Health will be able to provide not only affordable but also personalized medicine services through profitable costs and secured use of ICTs. Besides, the demand from patients as clients increases concerning new healthcare solutions in terms of self-managed care. This type of system enables to patients to be mobile and then helping them to keep the same living conditions such as professional activities, hobbies or family life. Nevertheless, through our research we notice that e-Health system should be adapted to every kind of needs, because it remains to be standardized in order to achieve e-Quality Health at the same level to every people [4].

In Africa, Health information systems (HIS) have seen significant improvements, but there are still serious gaps, and much remains to be done to improve their quality and opportunities towards people and economy. Few countries have sufficiently effective HIS to fully manage the Millennium Development Goals (MDG) launched by the United Nations. HIS have been chronically under-invested in the collection, analysis, dissemination and use of data. Even when they are available, data are often outdated and unreliable [5].

In recent years, the Gabonese government has made many efforts to revitalize the health system, notably through the multiplication of health centers and the improvement of health services with the new social protection scheme of the Caisse Nationale d'Assurance de Maladie et de Garantie Sociale (CNAMGS). Despite its improvements, Gabon as well as many African countries is faced with a number of problems inherent to the poor quality of care and the phenomenon of medical desertification characterized by the unequal distribution of enrollment across the entire territory, which results in the absence or the scarcity of health care services in rural areas. In addition, it should be noted that the lack of access to health information, due in particular to the lack of an efficient and reliable digital database and the dysfunctions of the information system, contribute negatively to the improvement of the health of Gabonese populations. Moreover, there is a weak coverage of the Internet network outside the major cities, as well as the problem of the lack of qualified health workers and the inadequacy of training with the current health needs [WHO].

Today, the solutions to these problems exist and can be applied to the opportunities created by the appropriate conditions to the installation and dissemination of e-Health system in Gabon in order to contribute to the strengthening of the Health information system, while promoting a better quality of care for patients.

2 Literature Review

The usage of e-Health is more and more profitable for many countries. Indeed, e-Health aims at supporting the healthcare system to help the professionals of this sector. According to some experiments from Norway or South Africa, it can improve care services towards patients as clients and then facilitate the work of doctors, nurses etc. At the beginning, investing in affordable e-Health applications may be expensive for countries but it will produce benefits if the system is well implemented in terms of rapidity, efficiency, quality of service and reduction of costs [3]. Such innovative technology in healthcare, allows for example to limit the mobility of handicapped individuals and to care about them at distance. Obviously e-Health is a proof of technological revolution in the healthcare's sector. Dealing with advantages of e-Health, several authors publish reviews upon this issue.

For example, in 2013 IEEE published a literature treating the Brazilian primary healthcare system based on the Context-Aware Mobile Approach (CAMA). It focuses on infrastructural support to provide value added to e-Health applications to become faster, safer and enables the reliability for both patients and medical staff [6].

In terms of advantages, in Japan for instance, regarding the fact that population is aging rapidly, and the diseases from aging increase, Government sets up the usage of e-Health in order to control this phenomenon and then reduce healthcare expenditures from the treatments. Thus, a platform based on the "Reduction of Days Spent for treatments" and Health

insurance systems have been established. It connects aged people at home to medical institutions by transmitting vital data via telecommunications networks. As result, the users are treated in shorter days maintaining their lifestyle this allowing the reduction of costs not only for medicals centers but also for the patients. If Japan continues to use e-Health in the future making improvements, it will reduce its expenditures of 1.5% of average per year according to the previsions made by the University of Hyogo [7]. Moreover, with a view to recognizing the need to adapt to the ICT tools in order to improve healthcare services, France has settled e-Health services to meet the special needs of French patients. Indeed, in 2013, it was found in France that about 3.1 million people have difficulty accessing a general practitioner, and nearly 15 million people suffer from chronic diseases that require specialized and adequate care [8]. In addition, considering the increasing of the cost of healthcare, France has chosen e-Health through the setting up of Telemedicine and the Dossier Medical Partage (DMP) in order to take over the management of patients and to provide remote services such as examinations, treatment or monitoring. Thus, these two ICT tools support the traditional means of providing care with the objective of supporting the emergence of digital health technologies in order to improve access to healthcare for all, while ensuring respect for Patient rights. Furthermore, it should be made clear that the technologies cited above have made possible the development of the public works management of information systems in the health and medico-social sector, which is a crucial device in the use of e-Health. Added to this, there are the secure healthcare messaging (MS Sante), the health professional sharing directory (RPPS), the health professional card (CPS) in the goal to ensure the safety and confidentiality of patients data.

Similarly, the needs of telemedicine development in the German health sector have proved to be crucial for improving the performance of the ambulatory sector, biological laboratories, by developing tele-monitoring and tele-rehabilitation centers and applications for Management of patients with chronic diseases, cerebral vascular accidents, diabetes and heart failure. In view of the foregoing, in 2013, two hundred and seventy (270) projects were counted to meet these medical needs of German patients, but only two (2) flagship projects were able to integrate the official health organizations, namely the project SCHWESTER AGNES which consists of making home visits thanks to a nurse tele-assisted by a doctor. The second is TEMPIS project which supports patients with ischemic stroke by solving the problem of lack of neurologists in 15 regional hospitals that are connected to two university centers specialized in neurology in order to carry out the treatment of Thrombolytic as soon as possible [9].

As another advantage, we can also quote the "Security Oriented Design (SOD)" created especially towards elderly people to reinforce the actions of e-Health and related systems. In fact, with the development of this item, patients can view their records online via web and mobile client's devices without need to go to the hospital each time. It also allows scheduling patients appointments and then to manage patient data as for example tests, prescriptions and visiting records [10]. Despite of these improvements, much remains to be done to use all the potentials of this particular technology already largely experienced in some countries like the United States.

In addition, some developing countries have also experimented with telemedicine technology in recent years with the aim of designing a low-cost tele-consultation and tele-education platform to improve the accessibility and equity of Healthcare

towards patients living in medically isolated areas using lower cost infrastructure and free online software. It is in this sense that Togo has designed this system which has permitted to consult patients at a distance through tele-radiology, tele-echography and tele-endoscopy between expert sites and isolated sites that is to say the regional hospital CHR Tsevie in Togo, the university hospitals CHU campus of Lome and Trousseau of Tours in France. Thus, thanks to a high-speed connection and remote control software, tele-echography, tele-radiology and tele-endoscopy sessions were carried out successfully [11]. As in the case of Togo, South Africa is also considered a pioneer in e-Health through the use of mHealth in Africa. Indeed, in Cape Town and Durban, South Africa, the Cell-Life project backed by Vodacom, has developed software and data management systems so healthcare professionals can use their mobile phones to monitor HIV treatment and identify potential health problems before they become life threatening. Data includes symptoms, compliance with drug regimes, ability to pay for transport to clinics and nutrition. A central database stores the information for access by healthcare professionals for their caseload of about 100 patients each [12].

3 E-Health Solution for Gabon

The development of ICTs, offers real opportunities in Gabon to take the challenges up in terms of relational, demographic, economic, scientific and especially medical matters. Obviously, e-Health should be a significant potential to develop certain health programs in order to ease more the health services in the country by optimizing better the needs and the current results of health information system. In its 2014 ranking of the most developed African countries according to their index of information and communication technologies (IDI), the International Telecommunication Union (ITU) considers that Gabon is the best in Central Africa and African French speaking countries [13]. Indeed, the government is performing several projects to optimize the use of ICTs in the frame of digital ecosystem development in all over the national territory and beyond the borders.

3.1 Growth and situation of internet in Gabon

Through the explanations given in previous sections, it is obvious that Gabon shows enough potential allowing the implementation of e-Health. Knowing that one of the first prerequisites is the internet access over the country. In fact, from 2011 to 2016, it is clearly noticed that the penetration rate of internet is being relatively and positively stable (Table1 and Figure1) on the basis of the population estimated at 1 517 685 inhabitants [14]. By considering the low level of population, it seems that Gabon is displaying good internet coverage in order to install eHealth technology not only for the population well-being but also to reinforce technical health system installations.

Table 1. Internet Annual growth adapted from [14]

Years	2011	2012	2013	2014	2015	2016
Internet Penetration Rate	17.78%	33%	41%	76%	67%	72.56%
Subscribers	282 776	497 371	742 538	1 150 814	1 009 719	1 101 231

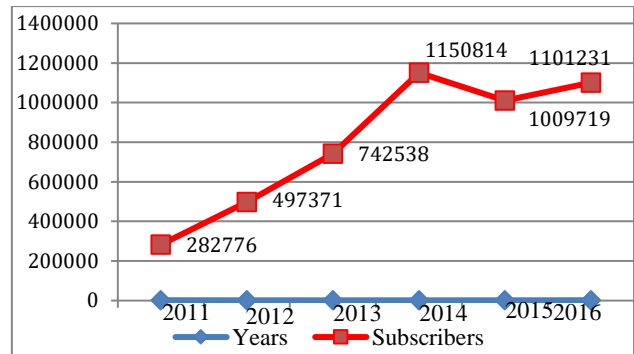


Figure 1. Annual evolution of internet penetration rate adapted from [14]

3.2 Core component of e-Health

According to Pan American Health Organization (PAHO) and WHO, the figure2 shows the mean to categorize and integrate the components of e-Health system into the global strategy of implementation in favor of medical personnel and patients.

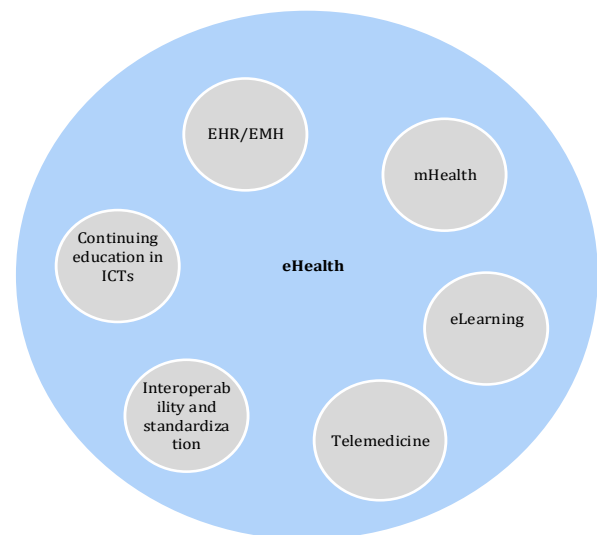


Figure 2: Components of e-Health adapted from [15]

Electronic Medical Records (EHR): It is related to electronic documentation of current and historical health, tests, referrals, and medical treatments concerned with the health of a person (WHO, 2006). This e-Health application is storing all specific medical data of any patient by reducing the gaps in decision making through a better access to patients' information.

Telemedicine: It is an e-Health system which has the capacity to bring healthcare services to patients in distant zones via an improved quality of health services by using accordingly and efficiently the health budget. It is also a technology that reduces travel time and stresses for the patients.

mHealth: This application is aiming at providing access to mobile-enabled EHRs anytime and anywhere on their smartphones, tablets and other mobile devices whose both patients and the medical staffs have an access. This helps medical staffs to use time more efficiently to achieve tasks like updating patient's medical data, keeping up with e-mail and prescribing medications at real time when it is needed and no matter the geographical zone.

e-Learning: This mean is used thanks to the ICTs for learning in order to promote a sufficient number of qualified medical

personnel. It helps improving the quality of education and increases access to it through innovative methods.

Continuing education in ICTs: The provision of courses or programs is delivered for health professionals including the medical staffs, who are not formally accredited just only to help them developing their skills in ICTs for application in health.

Interoperability and standardization: Interoperability is an e-Health tool dedicated to the communication between different technologies and software applications for the efficiency and accuracy of using and sharing of data. This relational system requires the use of *standards* that is necessary related to the rules, regulations, guidelines, or definitions with technical specification to achieve the integrated management and make health systems sustainable at all levels, by promoting the exchange and use of reliable data in an efficient and integrated method.

3.3 E-Health strategies

In global framework, the different components of e-Health strategies (Figure3) are established to maintain a formal institutional scope and guarantee the good operation of the overall infrastructures.

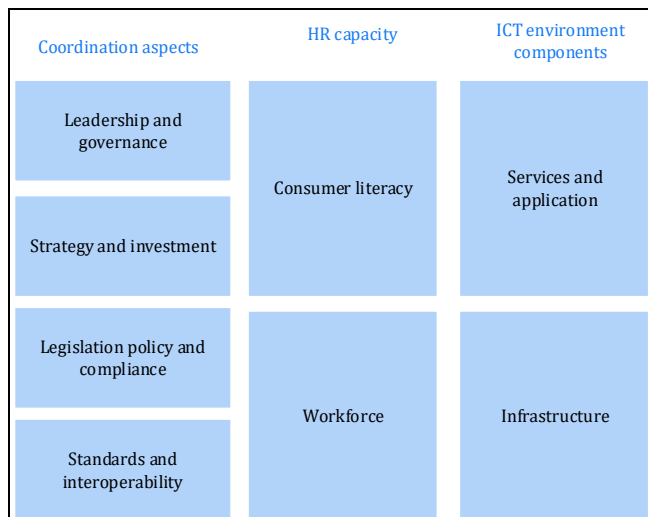


Figure3: Components of an e-Health strategy adapted from [16]

In this view, it is relevant to state that each component is specific and then achieves a particular target. Among the main concepts of e-Health strategy, the “Coordination aspects” is the one that is related to the central organizational policy with the purpose to strategize the functioning rules and to forecast and execute the major investments into health system.

As far as concern, “*the leadership and governance*”, refers to some tasks that involve with team members who make the major decisions in the goal to perform operations and assess the results of the projects. “*The strategy and investment*” tackles the creation of a strategic planning for seeking financing mechanisms in order to fulfill the national health engagement. Concerning “*the legislation, policy and compliance*”, it encompasses the strategic environment for legislating and regulating the use of data in the purpose of e-Health development.

The fourth toolkit about the e-Health strategy is the “*standards and interoperability*” which essentially indicates the scope of standards that is necessary to achieve the operability by

maintaining the exchange of information between the different systems available within e-Health system.

The second concept of e-Health strategy is essentially based on an adequate training of health professionals. Indeed, “Human resources capacity” is also required in terms of “*Workforce*” that performs the basic knowledge and skills needed for the development of e-Health efficiency through the education and training mechanisms and also the technical cooperation with the private sector in order to perform an appropriate health workforce. The Human resources aspects are also characterized by the “*Consumer literacy*” which is normally not included among the components of e-Health strategy but represents a significant aspect including electronic literacy for the development of a system according to WHO.

The other concept but not the least is focused on the “ICT environment components” such as technological services into health system. In fact, it emphasizes on the “*Infrastructure*” which has the goal to promote the exchange of information beyond the health system borders by collecting, organizing, saving and sharing data. The other component is related to “*the services and applications*” that is basically referred to the implementation of ICT tools for e-Health purpose and the software applications through they are applied.

3.4 Functions and Outcomes of e-Health Service

The benefits of e-health for Gabon can be presented as the means allowing to facilitating the treatment and sharing of information between medical staffs and patients via the use of EHR for an effective management of health system. The use of ICTs in healthcare system will significantly reduce errors, redundant examinations, unnecessary hospitalizations because data are in this case electronically stored by contrast to the former system based on paper which was causing errors while entering the patients’ records. As matter of fact, they will enable better diagnosis and the reduction of health costs through a good decision-making policy.

Furthermore, such a system will reinforce the quickness and fluidity of healthcare provisions towards the patients with the quality and safety of the health information in order to ensure a more efficient management of healthcare system (figure 4).

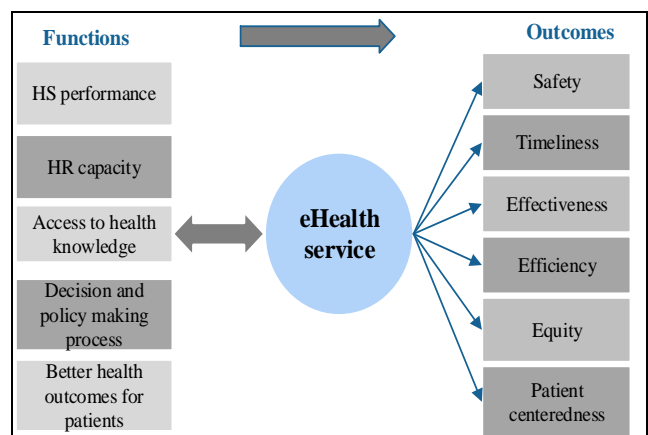


Figure4: Functions and Outcomes of e-Health Service

In addition, it is crucial to strengthen the medical staffs capacity to struggle against the lack of capacity by human resources through the tools like e-Learning or Continuing education in ICTs. Indeed, a proper training to e-Health technologies would allow care providers being able to face health challenges in rural areas and then to find efficient

solutions to some illnesses and to the infant mortality issues in Gabon. Finally, a strong and operational leadership in the scope of decision and policy making process would enlighten global strategic and financial orientations to manage accordingly the health system through some adequate monitoring and surveillance mechanisms of actions and decisions made by health system stakeholders.

4 MAIN CHALLENGES OF e-Health FOR GABON

According to WHO, the health system in Gabon still has many shortcomings in spite of the government's efforts in this area, judging by the under-five years infant mortality rate which remains high (65 % In 2012), the communicable and non-communicable diseases that continue to negatively impact the life expectancy of populations. Today, it seems necessary to implement a performing system in Gabon in order to strengthen and modernize the healthcare mechanisms by improving the access to health information with the purpose of having an efficient health system reachable all people. Indeed, e-Health technologies can meet the challenges currently faced by the Gabonese health system, such as: the poor quality of healthcare services, the dysfunction of the information system because of the lack of a reliable and effective digital data base for information processing, the lack of accessing health information, the medical desertification in rural areas and the lack of qualified health workers.

In the Table2, it can be noticed that some of endeavors made by government in the scope of the improvement of the digital environment in all over the national territory and beyond the borders by facilitating the extension of high-speed network, developing digital ecosystems through the creation of innovating jobs and then improving the basic healthcare's management in health system in Gabon. Indeed, in the framework of Gabon Emergent Strategic Plan (PSGE), the Gabonese authorities have put in place several projects related to the development of the digital economy to meet the diversification needs of the national economy, including: the Africa project Coast to Europe (ACE), which aims to extend Gabon's Internet connection via an optical fiber submarine cable to boost Internet network capacity on the international scale.

Similarly, through the project Central Africa Backbone (CAB), which supposed to be intercommunity, the country which wants to obtain its autonomy in international telecommunications, will be able to use this infrastructure to connect to the sub-region within the framework of the fiber Optical project Central Africa Backbone (CAB4), funded by the World Bank for \$ 58 million, whose the execution level has already reached 82% [17].

It also seeks to increase the geographical coverage of high-bandwidth networks and reduce the cost of communication services on the territory of the Gabonese Republic [13]. From this point of view, the willingness of government to strengthen digital mechanisms and services to boost the national economy and improve health system in the country is a reality. However, some aspects must be absolutely taken in consideration regarding especially the case of health. Indeed, today it appears crucial to introduce the technologies of e-Health in health system in Gabon. This will permit to ease the treatment and share health information, by improving the quality of service and reduce the government public expenditures on health services (Table3).

Table2: Governmental Current Projects

PROBLEMS	CURRENT GOVERNMENT PROJECTS	EXPECTATIONS RESULTS
Weakness of Internet Network capacities	-Central Africa Backbone(CAB) -Africa Cost to Europe(ACE)	-Extension of the geographical high-speed network coverage. Decline of communication services 'costs. -Improvement of the internet network capacities at international level to provide a better connection and security all over Central Africa Region.
Weakness of digital economy	Cyber Project in Mandji Island	Development of digital ecosystem promoting innovations thanks to the creation of jobs through the breed of start-ups that produce apps and services related to health information. Creation of a regional digital hub for eLearning, Telemedicine, eCommerce and eGovernment through the establishment of ICTs' companies like Google, Microsoft and Siemens. Innovation of new methods of managing health needs.
Lack of efficient health system	-eGabon	Improvement of the basic healthcare's management. Efficiency of health system.

Table3: New proposals' approaches

GAPS	OUR PROPOSALS	EXPECTATIONS RESULTS
Dysfunction of health information system Low quality of health care services	An adapted e-Health system so as patients or health provider can access directly at their home.	To enable a better follow-up system for the patients. To reduce government public expenditures on health services.
Absence of reliable and efficient digital database for managing health information Lack of accessing health information	The settlement of an effective database system. The settlement of an EHR system	To ease access, treatment and sharing information between health professionals and patients.
Medical desertification (Few Health providers in rural areas)	An adapted a Telemedicine system	to enable easier access of healthcare and provide better healthcare services
Lack of qualified health workers	An adapted training through an eLearning system. Training of ICT to medical staff.	To improve the quality of service toward patients. To increase the number of health providers

If only Gabon could have a telemedicine system that allows medical consultation and monitoring at distance, then an EHR system that gathers all the medical data of patients (laboratory analysis results, prescriptions, imaging, treatments ...) by integrating a good quality of training within ICTs tools towards

medical personnel, this will facilitate the treatment and sharing of information between health professionals and patients for the effective management of the latter. In addition, the adoption of such ICTs in healthcare system will lead, for example, to reduce redundant examinations, unnecessary hospitalizations, a better diagnosis and the optimization of health costs through good financial governance. Furthermore, the use of e-learning in Gabon's health system would necessarily improves the provided healthcare services and then increases the number of qualified health workers by enabling a better distribution of health providers all over the territory.

5 Conclusion and Discussion

The insertion of ICTs in healthcare is becoming a viable and sustainable solution to health issues in some countries over the world. The e-Health tools while they are accordingly used could provide at all levels an efficient healthcare service at low cost. As for developing countries like Gabon which are facing to many health issues in terms of illnesses and all kind of dysfunctions in management scope, the e-Health strategy could be the way to reduce the gaps and the absence of performance in health system. Indeed, despite of the government's endeavors in building medical centers, Gabon has been recording several health issues such as the poor quality of healthcare services, the dysfunction of the information system because of the lack of access to health information. Furthermore, there is also the lack of a reliable and efficient digital data base for the processing of information, the medical desertification in rural areas and the lack of qualified health workers. All these issues are unfortunately leading to the existence and the continuation of a significant rate of infantile mortality, malaria or other diseases. Considering the growing up of internet coverage in all over Gabon, the Telemedicine and the EHR for instance as tools of e-Health could be implemented in Gabon by using low cost software in order to improve the consultation and the medical monitoring at distance by including the processing and sharing of medical information between medical staffs and patients. Moreover, the use of e-Health must be standardized through a law framework that will allow offering better services in huge volume based on better quality. The role of national governments is crucial because they should be engaged in the adoption of laws facilitating the real use of this modern technology that can be strongly profitable for states in terms of health industry and in economic field as a pillar of economic development by optimizing the public health expenditures. The effectiveness of health system enables the well-being of people to produce wealth in the country. In the case of Gabon, structural reforms in health systems and the promotion of technology transfer are needed in order to settle e-Health down in the country. Thanks to an adequate implementation of e-Health strategies like mentioned above, by taking into account the gradual growth of internet from year to year, Gabon has enough potential to experiment eHealth to revitalize the infrastructures and population healthcare.

6 References

- [1] Ronell ALBERTS, Thomas FOGWILL, Adele BOTHA, Matthew CHETTY, "An Integrative ICT Platform for eHealth", IST-Africa 2014 Conference Proceedings, Paul Cunningham and Miriam Cunningham (Eds), IIMC International Information Management Corporation, 2014 ISBN: 978-1-905824-44-1.
- [2] Ying Su, John R. Talburt, "Assuring Data and Information Quality in eHealth", 978-1-4244-9763-8/11/\$26.00 ©2011 IEEE.
- [3] Nathalie FERRAUD-CIANDET, "Privacy and Data Protection in eHealth: A Comparative Approach between South African and French Legal Systems", IST-Africa 2010 Conference Proceedings, Paul Cunningham and Miriam Cunningham (Eds), IIMC International Information Management Corporation, 2010, ISBN: 978-1-905824-19-9.
- [4] Nick Hine, Françoise Petersen, Mike Pluke, Torbjørn Sund, "Standardization work on personalized eHealth systems", 30th Annual International IEEE EMBS Conference, Vancouver, British Columbia, Canada, August 20-24, 2008.
- [5] Francis BOGNI, "Analyse du système d'information de lutte contre la tuberculose au Cameroun", retrieved March 12, 2017 from http://www.memoireonline.com/08/11/4645/m_Analyse-du-systeme-dinformation-de-lutte-contre-la-tuberculose-au-Cameroun3.html
- [6] A. Neto, J. Junior, J. Neuman, E. Cerqueira, "Context-Aware eHealth Information Approach for the Brazilian Primary Healthcare System", 2013 IEEE 15th International Conference on e-Health Networking, Application and Services (Healthcom 2013).
- [7] Yuji Akematsu, Masatsugu Tsuji, "Economic Effect of eHealth: Focusing on the Reduction of Days Spent for Treatment", 978-1-4244-5014-5/09/\$25.00 ©2009 IEEE.
- [8] ASIPsante, "La e-sante au benefice de tous", www.esante.gouv.fr, 2014.
- [9] H.-J. Brauns, "Le développement actuel de la telemedecine en Allemagne", European Research in Telemedecine/La Recherche Europeenne en Telemedecine (2014) 3, 3-7.
- [10] Weider D. Yu, Lavanya Davuluri, Monica Radhakrishnan, Maryam Runiassy, "A Security Oriented Design (SOD) Framework for eHealth Systems", 2014 IEEE 38th Annual International Computers, Software and Applications Conference Workshops.
- [11] K. Adambounou, F. Farin, V. Adjenou, "Plateforme de telemedecine moindre cout pour les pays en developpement", European Research in Telemedecine/La Recherche Europeenne en Telemedecine (2013) 2, 49-56.
- [12] Tom J., Karl S., Alexander D., Veli S., "eHealth for African Countries-Sustainable Strategies", IST-Africa 2011 Conference Proceedings. Paul Cunningham and Miriam Cunningham (Eds), IIMC International Information Management Corporation, 2011, ISBN: 978-1-905824-26-7.
- [13] Beaugas ORAIN, "Le Gabon, un exemple dans les TICs en Afrique francophone", 2015, retrieved December 20, 2016 from <http://www.ictmedia.cm/le-gabon-un-exemple-dans-les-tic-en-afrique-francophone>
- [14] ARCEP Gabon, Observatoire des marches
- [15] Pan American Health Organization/World Health Organization, www.paho.org/ICT4health [WHO 2006] Building Foundations for e-Health', Progress of Member States. Report of the WHO Global Observatory for e-Health
- [16] Adapted from World Health Organization (WHO), 2012, National eHealth strategy toolkit, viewed 17 march 2017.
- [17] Gabon: bilan satisfaisant de la phase Une du projet de fibre optique CAB4 réalisé à 82%, posted on 20/06/2016 retrieved December 20, 2016 from <http://www.socialnetlink.org/2016/06/gabon-bilan-satisfaisant-de-la-phase-une-du-projet-de-fibre-optique-cab4-realise-a-82>
- [18] Martin N., Dejan Z., Esther A. A. O., Jane C., Doris K., "Assessing the feasibility of eHealth and mHealth: a systematic review and analysis of initiatives implemented in Kenya", Njoroge et al. BMC Res Notes (2017) 10:90 DOI 10.1186/s13104-017-2416-0.