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Reverse Innovation in Technology-Based Foreign Language Learning: Results of Three Surveys of Secondary and Higher Education Institutions in Cameroon

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Abstract

Conceptualised in the field of management sciences, the theory of Reverse Innovation states that there are processes of technologies' and knowledge transfer operating from the base of the pyramid (i.e., the least economically and technologically developed countries) to the top where most of the industrialised nations are found. This article presents three field surveys carried out with secondary and higher education institutions in Cameroon. It shows that developing countries are contributing to the enrichment of technology-based foreign language learning through technical, pedagogical, and didactic adaptations carried out daily.

Keywords

Reverse Innovation, Transfer, Survey, Technology-Based Foreign Language Learning, Adaptation

1. Introduction

It is generally considered that innovation (from the Latin word "*innovatio*" [= renewal] indicates that new organisational forms, institutions and technologies must be implemented cf. Ostraszewska & Tylec, 2015: p. 58) spreads from a centre to the peripheries, where technological and economic needs are most significant. This is for example the popularised concept of technology and know-how transfer occurring from the developed countries to the poorer nations of Africa, Asia and Latin America. But as we know today, this view is partly wrong. If Schumpeter (1934) in his traditional theory of innovation diffusion had com-

pletely ignored the re-appropriation factors of technology conceptualised in the sociology of development, he wouldn't have imagined that a development wave could spread from the less developed countries and impact the whole world. Let me give some examples: the observation of the international markets evolution shows that there is a restructuring of economic, social and even scientific, technological power relations that are being reversed. Companies are now increasingly producing some goods based on local needs and realities (i.e., costs, infrastructures, regulatory frameworks, cultural differences, etc.). Furthermore, it is nowadays common to see multinational companies relocating to emerging and developing countries like India, China and Brazil (Zeng & Williamson, 2007; Hadengue & Warin, 2014). These processes of technologies and knowledge transfer operating from the base of the pyramid to the top are generally called reverse innovation (RI) following the scientific current developed by Govindarajan & Trimble (2012) in business administration. The reverse innovation theory states that the innovative ideas and technological applications could be developed in emerging and developing countries before being reintroduced into the *High-Income-Countries* (HICs) and used there.

However, if many examples of reversed innovation processes are now found in several fields of study like management, engineering and health, this theory still remains scientifically new for educational sciences, where the newly imported technology-based learning approach implies (re)-appropriation requirements and innovative (re)-adaptation in the developing and emerging countries. The following question arises: how does the use of new media transfer technological innovations into the classroom and which kind of reverse innovation processes are observable?

Based on the conceptual framework of my PhD thesis in which I set out the premises for a model of reverse innovation for technology-based foreign language learning (Nanga-Me-Abengmoni, 2019), this paper aims to deeply explore the concept of reverse innovation in technology-based learning of German as a foreign language and to provide empirical evidence of the existence of such a process in secondary and higher education schools in Cameroon[1]. The results presented here benefit from data collected since 2018 as part of a longitudinal research project on the impact of mobile learning in the Cameroonian educational system.

2. Conceptual Framework

Reverse Innovation (RI) is popularised since 2009 in the domains of business and management (Immelt et al., 2009) and refers to new ideas and solutions that are firstly adopted and tested in the *Low- and Middle-Income Countries* (LMICs) before subsequently being spread to *High-Income Countries* (HICs). The concept, which has an initial focus on enterprise development and economics, is

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[1]I would like to thank Ms Ngankou Ngounoué Alexandra for her valuable proofreading. I take full responsibility for the remaining possible errors appearing in the text.

nowadays applied to many areas of science and social life, where various models are provided. In reality, the idea that innovation is initiated from other developing countries is basically not new (cf. among others Christensen, 1997; Brown & Hagel, 2005), but the paradigm shift in this new approach of innovation diffusion consists in restructuring the relationship between producers and consumers of technological progress with the elimination of the dichotomy of centre and periphery (Schumpeter, 1934). The theory of RI assumes that the technological and economic development processes can be reversed and particularly provides examples driven evidence of innovation coming from the existential difficulties and developmental needs in the LMICs (DePasse & Lee, 2013: p. 1). It is important to realise that RI, in contrast to the previously mentioned paradigm, presupposes mutual profit between LMICs and HICs (Hadengue et al., 2017: p. 144). It is roughly a give-and-take meeting, whereby each side can meet its own development needs regardless of its income level. For example, in developed countries, specific development conditions can be reflected starting from innovation in emerging markets, while the economy gets adequate goods for consumption from LMICs, so that every market has its own culture, values and taste (Govindarajan & Trimble, 2012).

Another particularity of RI is to provide specific solutions to issues that were not previously addressed in an affordable or cultural sensitive manner (Zinsstag et al., 2019: p. 1). Therefore, the income gap (but not necessarily based on economic constraints) between developing countries and HICs can be adapted according to current costs, sustainability of the product, preference of the socioecological context, commodities of the market and legal and regulatory requirements. This is the case, for example, with the introduction of fibre optics and mobile communication in LMICs, where the technology has not only been rapidly adopted by consumers, but has also enabled the development of new applications and packages such as mobile money, tailored to the needs of local populations and which can be transferred back to more developed economies as mobile banking services.

With reference to technology-based learning, RI does not necessarily introduce technological advances into LMICs for the first time before applying them in HICs. The fact that multimedia teaching/learning processes are also tested in the LMICs gives the global technology enhanced education system a chance to check transfer possibilities, where HICs could benefit from adaptations made in the LMICs (Nanga-Me-Abengmoni, 2019: p. 85). In this spirit, the flourishing conceptual diversity of RI offers a variety of definitions, which contribute to a better understanding of its transdisciplinary scope. In fact, different innovation concepts have been stipulated and, in addition to inclusive innovation, terms such as blowback innovation, BOP [bottom of the pyramid] innovation, have been introduced into the discussion (Kaplinsky et al., 2009; Zedtwitz et al., 2014).

Often seen as the opposite of *glocalization* (i.e. the development of local prod-

ucts distributed worldwide with some adaptation to local markets cf. Immelt et al., 2009), RI must be distinguished from other well-known and quite similar innovation concepts. Indeed, the dominant concept of inclusive innovation has existed since the 2000s and is nowadays subject of debate. In its first assertion, the inclusive innovation refers to an inclusive development, i.e. the inclusion of some aspects of innovation of groups who are currently identified as low income communities or countries such as ethnic minorities, women, youth etc. (Codagnone, 2009). Here differs the inclusive innovation from the traditional view of innovation as a generalised economic growth, because it explicitly conceives development *"in terms of active inclusion of those who are excluded from the mainstream of development"* (Foster & Heeks, 2013: p. 3). Four aspects of inclusivity have already been highlighted in the discussion. They are 1) the inclusivity of innovation precursors (e.g. when problems that need to be addressed by innovation are of relevance to the poor.); 2) the inclusivity of innovation processes (e.g. when the poor are involved in the development of innovative goods and services); 3) the inclusivity of innovation adoption (e.g. when the poor consumers have the capability to absorb innovation); and finally 4) the inclusivity of innovation impacts, e.g. when the innovative goods and services have a beneficial effects on the livelihoods of the poor (cf. Foster & Heeks, 2013: p. 3). It should be noted that, unlike RI, inclusive innovation only considers minorities and partly LMICs in development planning, so it does not refer to any innovation process that might spread from LMICs and then be introduced into more advanced economies.

On the other hand, the term blowback innovation is used to describe innovative solutions that are developed and adopted first in emerging markets (Hart & Christensen, 2002). For Brown & Hagel (2005), blowback innovation expresses the need for multinational manufacturing plants in developed countries to produce goods for specific market needs in emerging and developing countries. The authors show that multinationals from HICs would lose access to emerging markets and be replaced by local industries if their way of doing business in that part of the world is not rethought. These ideas clearly give the economy-based option of blowback innovation that, in contrast to the inclusive one, aims to reshape business and management practises in order to gain access to emerging markets and avoid being displaced by own national companies from emerging nations (Hadengue et al., 2017: p. 144).

Furthermore, the BOP [bottom of the pyramid] innovation also called by Prahalad (2004) trickle-up or Ghandian innovation with reference to the two Ghandi recommendations of affordability and sustainability in the Indian market (Ostraszewska & Tylec, 2015: p. 62), refers to any innovation process that is introduced from the bottom of the pyramid (LMICs) to the top (HICs). Based on the needs of the BOP market, which is made of about 3.4 billion people living on less than 3.20 USD per day (The World Bank, 2018), this type of innovation particularly adapts products to the mostly heterogeneous and fragmented consumption

abilities and manners in the developing economies. According to Prahalad (2012), the BOP market requires multinationals to take a completely different approach to doing business which involves four (4) reshaping factors: 1) the consumer and producer awareness of the availability and uses of manufactured goods; 2) the consumer access to products and services provided; 3) the affordability of products and services, which must be of good quality at a low price; at last 4) the availability or the continuous supply of products and services.

However, if the BOP innovation is similar to RI in several aspects (both entities imply a spread of innovation that is subsequently trickled up to HICs), it should be noted that RI is not limited to the economic constraints. The RI concept includes other social, scientific and technological aspects of LMICs which are able to enrich the know-how and practices particularly in the HICs:

> While trickle-up innovation is necessarily destined to meet bottom of pyramid needs, RI is rather to meet new or different needs proper to developing or emerging markets, regardless of income levels. In other words, RI is driven by constraints specific to developing or emerging markets, which include but are not limited to cost constraints (e.g. lack of infrastructure or even cultural differences between developed market customers and developing or emerging market customers). (Hadengue et al., 2017: p. 144)

This is to say that RI should go above the economic constraints of markets and integrate a transdisciplinary approach, which should take into account both the relationship between LMICs and HICs, but also the transcendental boundaries of infrastructural, cultural, scientific and subject-specific differences. In this paper, I argue that RI can also be researched in technology-based foreign language teaching/learning processes in LMICs education systems. The study is conducted on an empirical basis and is illustrated by examples of flipped educational technologies from the developing country Cameroon.

3. Domains of Reverse Innovation

This section analyses the research results in some areas of application of RI. Despite its theoretical origins in the humanities and social sciences, the great diversity (still growing) of domains of RI is found in the basic and applied sciences such as medicine, agriculture, engineering etc. In this collection, however, the focus will be on health and educational technologies, as these will form the immediate theoretical background to the present work.

3.1. Health

Health care is nowadays considered the most prominent area of application of RI. According to Zinsstag et al. (2019: p. 1), RI in this domain (there is fortunately no exhaustive list) can easily be applied to 1) financing, 2) governance, 3) health information systems, 4) health service delivery, 5) leadership, 6) research and product development, 7) partnerships for new diagnostics, 8) drugs and

vaccines. Indeed, RI for health information systems has been implemented for instance during the Kenyan presidential election in 2008 and the Haiti earthquake in 2010, where a crowdsourcing programme to map disaster impact and response has been used. Especially the gap identified in these two developing countries, i.e. the widespread use of mobile technologies and the lack of pre-existing infrastructures, has allowed the successful transfer and re-adaptation of this programme in the US State of Louisiana, where it has been used to manage infrastructures destroyed by the hurricane Nate in October 2017 (DePasse & Lee, 2013: p. 4).

Another example is the human and veterinary medicine project "*One Health*" conducted by the Swiss Tropical and Public Health Institute of the Basel University in Switzerland (Zinsstag et al., 2005, 2007, 2019). The research focuses on the question of how could a closer cooperation between human and veterinary medicine help to improve the wellbeing of both humans and animals and maybe the financial savings. A particular finding of this project, from developing countries in Africa such as Chad and Mali, is that the control and elimination of zoonotic diseases require a different model of effective, low-cost health care, in contrast to HICs where almost massive state budget support to farmers is required. Zinsstag et al. (2019) elaborate on this base a model of RI for global health that undergoes nine main steps (**Figure 1**).

At the first place, the recognition of a phenomenon plays an important role in the process of RI, as this will be the subject of the partnership between LMICs and HICs (for example the treatment given to humans and animals in the two regions). For this partnership to be fulfilled, it is necessary to reduce the misunderstanding and sociological barriers through intercultural and multi-language competences. It means that both parts in the cooperation need to learn from each other and to adapt their own cultural, linguistic and social manners. This stage is primordial for the next to occur; that is self-reflexivity based on own background. In other words, the stakeholders should reflect on their competences

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❖ Recognize the phenomenon

❖ Reduce barriers through social, intercultural and multi-language competence

❖ Be aware and reflect on own background (self-reflexivity)

❖ Engage with stakeholders in participatory, intercultural and transdisciplinary processes

❖ Adopt a mutual learning and partnership attitude

❖ Share understanding and benefits of partnership

❖ Learn and share practical examples

❖ Build capacity and professional education

❖ Apply and share benefits

Figure 1. Steps of reverse innovation in global health (Zinsstag et al., 2019: p. 3).

and needs before going through the step, which engages them in a participatory, intercultural and transdisciplinary process (in this case the inclusion of different cultures, knowledges and scientific disciplines). That is why it seems very crucial in a RI process to adopt a mutual learning and partnership attitude that are respectful of both parts and contribute to a mutual enrichment in the LMICs and HICs. The sharing of findings is also potentially helpful for all stakeholders to meet their development and research needs. Learn and share practical examples therefore acts as the seventh milestone for a successful RI. On the other hand, the capacity building and professional education should not be neglected as they are very important for the sustainability of the partnership. It supposes that stakeholders from LMICs and HICs are trained, so that they can apply and share benefits of the project in an affordable manner. In the next subsection I am giving an example of RI in the field of educational technology.

3.2. Technology Enhanced Learning

The application of RI in the domain of technology enhanced learning is still new. In my PhD, I did a pioneering work on the role of RI in technology-based learning where an applicable model of RI for mobile learning was designed. One should note that the use of mobile devices for foreign language learning hides a discrepancy between industrialised, emerging and developing countries, but it is precisely through mobile learning that innovative forms of cooperation between LMICs and HICs—that are not solely based on development aid—are opening up. Given that the use of mobile devices in schools worldwide remains so far in its experimental phase (Deschanps, 2011; Mian Bi Séhi, 2012; Karsenti et al., 2013; Nanga-Me-Abengmoni, 2017), it is of interest to test and compare models of m-learning integration in order to allow for a transfer or impact on other international learning spheres. The model of RI proposed (see below) is based on DePasse & Lee (2013) (Figure 2).

The first step of innovation is considered to be the identification of a problem—in our case, the impediment to the use of mobile devices for the completion of learning purposes. This problem, which is a concern for both HICs and LMICs, is thus first further elaborated and solved in emerging countries before being trickled up to HICs (cf. the crossover). Important in the innovation process is the dissemination within the community. According to DePasse and Lee, it is about a dynamic wave of development that is firstly received by innovators. This group constitutes only 2.5% of the entire population. Next come the early adopters (13.5% of the population), who become familiar with technological innovations at an early stage and integrate them into their everyday lives. The early majority makes up only 34% of the society. The other part of the population remains on the sidelines of innovation for a slightly longer time. The crossover introduces know-how and practical experience from emerging to developed countries. This process is in fact not a hundred percent reproduction or application of the knowledge from the original milieu, but rather a processing of the results gained for further development and refinement in the new environment.
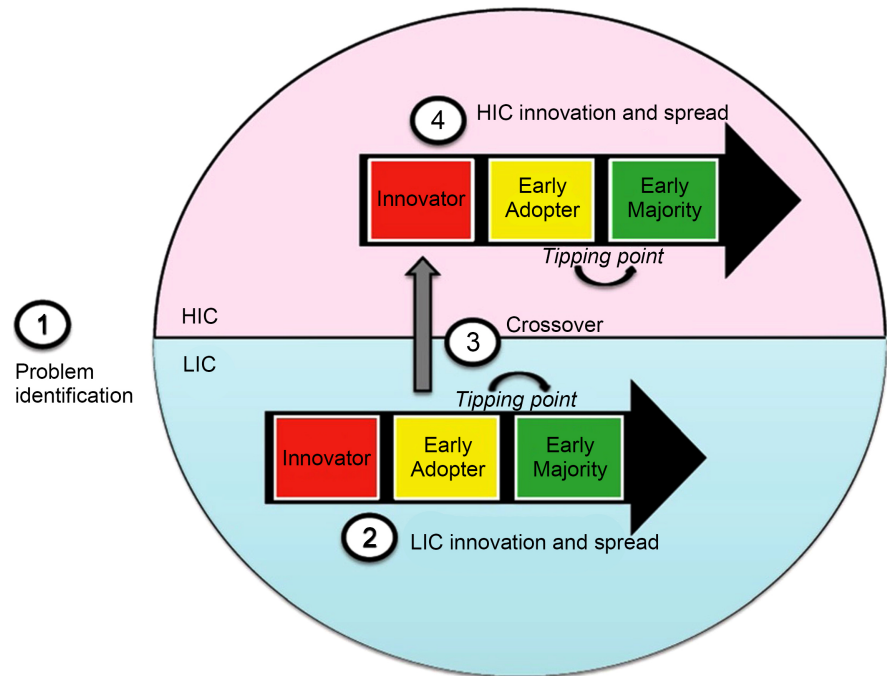
Figure 2. Model of reverse innovation (DePasse & Lee, 2013: p. 3).

4. Methodology and Empirical Findings

4.1. Methodology

As mentioned above, this study benefits from three empirical surveys conducted from 2018 to 2021 as part of the "*Digital Learning Educational Design Research Project*" that the author is currently conducting in secondary and higher education institutions in Cameroon. The project consists of a longitudinal study of the teaching/learning interaction of German as a foreign language (DaF), which has been carried out within the framework of elective multimedia courses. Due to the object of investigation, the project requires a method-combining design with a partly quantitative and partly qualitative methodological orientation (Kolleck, 2017: p. 72). This combination of methods results from the consideration that the analyses will thereby gain both breadth and depth. For this specific study, the highlighted results have the characteristics of a hypothesis-generating study, because the aim is to formulate well-founded assumptions about the transfer possibilities of m-learning to other international learning spheres.

The first survey conducted in summer 2018 from June to August was made of two online questionnaires (one for students and one for lecturers), which were filled out by a total of thirty lecturers and four hundred students at the universities of Yaoundé 1, Douala, Bertoua and Dschang. In addition, qualitative data collection was carried out through the guided interview, which was conducted with seven experts in German as a foreign language didactics and in information and communication technologies (ICT) at the four Cameroonian universities mentioned above.

The second survey was conducted during the corona-pandemic from 27 April

to 31 May 2020 at the Collège Saint Coeur in Mbalmayo and consists in testing a mobile learning infrastructure on the WhatsApp platform (Nanga-Me-Abengmoni, 2022). The evaluation method is both quantitative and qualitative with the questionnaire and literature review of the weekly teaching reports among teachers, and among learners the questionnaire and focus group discussions. The ninety seven students and ten teachers who made up the project sample expressed, among other things, their difficulties in adapting to technology-based learning as well as their resilience strategies that could constitute transferable knowledge to other teaching/learning situations.

Likewise a data source triangulation with qualitative and quantitative orientations was applied to the third survey. The empirical data collection took place at the University of Yaoundé 1 and the Higher Teacher Training College Bertoua. The qualitative phase consists of longitudinal research into German as a foreign language teaching interaction, which was carried out during the winter semester from October 2020 to April 2021. The sample for the semester-long teaching experiments was made up of fifty two bachelor's and master's students participating in the course offering. The three Educational Design Research projects each pursue two main goals: 1) create, analyse and reflect on media-based interventions (e.g. curricula, teaching/learning strategies and materials, online systems and products) to solve foreign language didactic problems; and 2) integrate these media-based interventions into a scientific research practice of broader scope. For this purpose, a needs analysis was conducted based on focus group discussions and learning biographies of the test persons. Furthermore, the learning products (i.e. the developed curricula and frameworks) were analysed in terms of content and the opinions of test persons on the impact of the design on the learning process and possibilities of transferability were gathered through group discussions. The qualitative stage was followed by a quantitative stage, which was used to verify the developed local theory based on a questionnaire action with all the teachers and learners. This stage also took place at the two universities with a total sample of one hundred students or prospective German teachers and thirty lecturers.

4.2. Findings

Five main findings in relation to RI in the Cameroonian context can be derived from the analysis of the data.

1) The results show that there are advancements helping to reduce technical difficulties and the digital divide in LMICs. Due to the low capacity of android phones sold in the Cameroonian market (the recurring problems noted are related to the reduced storage capacity, the processor slowness, the operating errors and the quality of the camera), mobile learning could not be completed efficiently; but thanks to new apps such as the *Wechselpräpositionstrainer* (Nanga-Me-Abengmoni, 2017), mobile devices can process their own data. This learning programme developed by a group of African software designers offers the ad-

vantage of using less memory and guaranteeing good ergonomics as it is made with small software found inside the android phone that directly take data from the device. For example a person who has an android phone with a RAM capacity of 256 MB, can do training actions like on a Moodle[2] learning platform with the development of a well-adapted tool.

2) Furthermore, the problem of network coverage in the country could be solved by the Global System for Mobile Communication (GSM). It is therefore possible to introduce Short Message Service communication (SMS) within the framework of an m-learning model. Especially for the discussion in the forum or for various feedbacks from the teaching partners, SMS communication plays a supporting role in realising the learning process independent of time and place. This proposed adaptation process of SMS-based learning in the Cameroonian context will therefore be used to continue the m-learning research. Accordingly, learners will no longer need internet access to submit their learning assignments or to participate in the chat and forum discussion with teachers. This could also save money and energy supplies.

3) Experience with java-based programming has also shown that by re-encapsulating messages for Application Programming Interfaces (API) using internet via SMS and by putting a server somewhere that does data interpretation, someone can work on his mobile phone using SMS as if he was on the internet. Mobile learning application takes the information from the server, and organises the learning; then the learner changes the parameters which are sent back to the server and the server sends the assessment. Admittedly, this does not have the same fluidity, but by increasing resources through international cooperation, it would be possible to set up coherent infrastructures that meet training standards engineering and ensure that variation in skills follows a predefined curve.

4) Moreover, WhatsApp distance learning project not only offered the scientific community a techno-pedagogical device that can be replicated in other research circumstances, but also provided empirical evidence of the added value of the WhatsApp application in the teaching/learning/evaluation process. The results show that the didactic intervention on the WhatsApp platform is possible if a daily lesson plan with strict timetables is respected as in traditional classrooms (Nanga-Me-Abengmoni, 2022: p. 13). Here the lesson can be based on the application's own materials such as images, texts (word and pdf), videos, and audios or on the discussion thread in the group. According to Béché (2015), learners develop strategies of diversion on a daily basis to bring mobile phone into school; this diversion for learning purposes (Attenoukon et al., 2016) can be seen as a resilience strategy and RI when we know that the American instant messaging company is used basically as a social network for meeting and communicating with friends.

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[2]Created in 1999 by a Web administrator at Curtin University in Australia, the Moodle platform (Modular Object-Oriented Dynamic Learning Environment) is a free, open source Learning Management system (LMS), which latest version is present in more than two hundred countries worldwide and available in more than one hundred languages.

5) With regard to lesson planning, social networks (Facebook and WhatsApp) serve as tools for synchronous and asynchronous interaction between teachers and students, but also between students themselves. Indeed, social media can be used as a complement to the unfortunately often insufficient working time in the classroom and contribute particularly to making exercises and learning materials available to learners regardless of time and place. The learning situation is also enhanced by voice messages sent directly by native speakers or by the teacher, which help to improve skills such as listening and speaking. This also helps to reduce the student dropout rate (Alemnge, 2018).

5. Discussion

Based on the results presented above, it appears that the technology-based foreign language learning can participate to RI processes between African countries and the rest of the world.

At a technical level, there is a need to simplify distance learning processes in order to adapt those to all social and professional strata as well as levels of education (primary, secondary and tertiary). If until the 2010s mobile learning was confined to a few pilot schools worldwide, its implementation since the advent of the android phone at lower cost in developing countries has experienced a rapid rise—especially given the adaptations in the internal components of mobile devices. This re-appropriation in the context of emerging economies should contribute on a larger scale to the simplification of learning procedures while better preserving and improving the achievements of technology-based learning. These changes have already been implemented in various learning platforms, such as Moodle, thanks to mobile devices, because nowadays you can log into a school platform anywhere with your device, where you can design your teaching/learning activities in a flexible and mobile manner.

At a pedagogical level, the diversion of entertainment platforms and social networks initially intended for communication between friends towards teaching-learning purposes proves the existence of an inversion of the innovation curve. In fact, the involvement of social networks in educational activities should be understood as a desire to adapt the cost of distance learning to the real purchasing power of the BOP-market (development and hosting of a dedicated platform should involve high expenses), but also as a method of popularising mobile learning, given the 75% annual penetration rate recorded during the last five years among the younger generations. Several forms of North-South cooperation (projects, collaborations, exchange classes, etc.) have already been inspired by this new approach.

At a didactic level, foreign language learning finds in the re-appropriation of mobile media in developing countries effective methods for the development of learners' skills. Indeed, there is a permanent connection with the target culture and above all a densification of the learning volume through a better availability of didactic resources.

6. Conclusion

This paper had the objective to evaluate the RI in Technology-based Foreign Language Learning through technical, pedagogical, and didactic adaptations carried out in the LMICs. The empirical evidence has been provided that specific m-learning processes in LMICs contribute to the enrichment of technology-based foreign language learning in all the parts of the planet due to the (re)-appropriation and innovative (re)-adaptation of learning tools occurring in the developing and emerging countries. In sum, the situation of learning technologies in Cameroon as presented here needs to be positively changed, especially through intensification measures. National and international investors have an essential role to play. It is predominantly a question of the acquisition of infrastructures as well as the administration and pedagogical support.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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