

INTRODUCTION, ADOPTION AND EXPANSION OF THE VETIVER SYSTEM TECHNOLOGY IN CONGO-KINSHASA, CONGO-BRAZZAVILLE AND UGANDA REPUBLIC: EXPERIENCE GAINED FROM 2003 TO 2014

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Abstract

Despite its many benefits, vetiver technology often faces some barriers which hinder its adoption and its large scale use, contrary to all expectations of those who are involved in promoting it across the world.

The experience acquired from Congo - Kinshasa, Congo - Brazzaville and Uganda from 2003 to 2014 indicates that these barriers are located at four different major levels: 1) policy makers, 2) infrastructure construction companies, 3) local people and 4) the person or group of people involved in vetiver technology popularization. These four factors simultaneous play a very important role in the success or failure of the adoption and expansion of vetiver technology in any country.

In order to overcome these barriers in any country, not only the advocacy skills and persuasion capacity of the person or group of people supporting vetiver technology, but also the successful demonstrations on small-scale of this eco-friendly technology. These are the main keys to open a large scale adoption and use of vetiver technology in any country.

This approach has been successfully achieved at Congo - Kinshasa since 2003, Congo - Brazzaville since 2008 and most recently in Uganda since 2013, where some projects using vetiver grass were successfully implemented and the adoption and expansion of this green technology in these three countries in Africa are nowadays effective, with more than 35 million vetiver slips used in about 14 different known projects and 28 different partners were involved, through which vetiver technology continues to be disseminated.

Keywords: Vetiver grass, Vetiver System Technology, adoption, expansion, experiences sharing

1. INTRODUCTION

The Vetiver System is undoubtedly a valuable technology in tropical area in general and African countries in particular, due to its multiple benefits, such as simple implementation, low cost, sustainable technology, etc.

However, despite its multiple benefits, vetiver system often faces some difficulties for its adoption and large scale use due to some barriers, sometimes understandable or not, according to the host country.

The experience gained so far from transferring this environmental friendly technology by TVNI in the Congo - Kinshasa since 2003, from its integration in infrastructure projects in Congo -

Brazzaville since 2008 and just recently in Uganda in 2013 for road batter protection, could indicate some reasons which are in our opinion, among the constraints of the adoption and large scale use of this green technology as fast as it is expected. They are located at four major levels in the successful implementation of a project involving vetiver.

1. The first factors are policy and decisions makers or project owners. Doubts and pessimism from this group could happen, related to the effectiveness of the vetiver system, which is considered by them as an unknown practice. The barriers in terms of regulations of bringing foreign species to a new areas could also be noticed from this group.
2. The second factors are the companies hired for the implementation of infrastructure projects. At this group, reserves for adopting and widening out vetiver system are often linked paradoxically to its very low cost compared to alternative conventional engineering solutions usually proposed by these companies which are expensive and very financially profitable for their business.
3. Then, the local population as potential nursery operators could play in this stage as vetiver suppliers. The concern in this group to not meet sustainable business opportunities after investing time and money in propagating vetiver, play also a significant role because the unavailability of vetiver slips in project area is among constraints of using vetiver system in large scale.
4. Finally through these above factors, the person which is involved in introducing vetiver technology remains the success keys. His advocacy skills and persuasion capacities towards policy or decision makers, projects owners and companies hired for the project implementation play the biggest role for adopting and widening successfully the vetiver system; because he has first to work not only for creating the demand of vetiver system from the policy makers or companies side, but also to get local population involved in propagating in nurseries and supplying vetiver slips according to the need of the project.

Therefore this article aims at sharing experiences from projects by which vetiver system have been successfully introduced, adopted and widely used in Congo-Kinshasa, Congo-Brazzaville and Uganda Republics in Africa.

2. MATERIALS AND METHODS

2.1. Materials

Vetiver slips from *Chrysopogon zizanioides* are the materials used for all these projects. Its availability in the project area is one of the key arguments to persuade decision makers or project owners for the feasibility of project implementation. In most cases, vetiver can always be found in these areas or surroundings. Some literatures inform the existence of vetiver grass in the region many decades ago. However, in these three countries, vetiver has never been used before for bioengineering purpose. It was used only for land delimitation.

In most cases, the initial quantity of vetiver clump found in project area or surroundings were less than the project need and could only allow some demonstrations. In this case, the involvement of the local population and the company hired for the infrastructure project implementation were very important for increasing vetiver offer by creating nurseries which can produce number of vetiver clump needed by the project.

2.2. Methods

2.2.1. Advocacy toward policy makers, construction companies and potential nurserymen

Several meetings were held both in Congo-Kinshasa (Ministry of Public Works, Vice-President of Republic in charge of infrastructures, Congo Brazzaville (DGGT: Délégation Générale des Grands Travaux) and Uganda (UNRA: Uganda National Road Authority) for firstly to explain to policy makers or project owners the benefits of the integration of vetiver into their various infrastructure projects; and then, to present to them various projects around the world, which have successfully used vetiver system in infrastructures projects.

On the side of infrastructure companies, the benefits of vetiver system were presented in particular with regard to the reduction of maintenance costs of the works during the service warranty period, and therefore the ability of the company to save money.

The implication of local population for supplying vetiver slips to projects was timidly noticed at first, then increasing slowly and becomes finally widespread as well as vetiver demand also increases.

2.2.2. Small-scale demonstrations

After the advocacy and persuasion step, small-scale demonstrations are very important milestones for further adoption process of vetiver system because, the acceptance of the effectiveness of vetiver system as an innovative technique depends solely to successful results of these demonstrations. In all three countries above, these demonstrations have been very successfully achievement, which provide evidence that enable policy makers and project owners in their respective countries to be convinced and confident that vetiver system is a proven green technology and must be effectively integrated into all infrastructure projects required its use.

In Congo - Brazzaville and Congo - Kinshasa for example, one of the main conditions for all contracts for projects such as road works and erosion control, require explicitly the bidder companies to use vetiver for slope and drain protection wherever it is needed

2.2.3. Large scale adoption and use of vetiver grass in various projects

This is the final phase of successful introduction of vetiver system because it is much more focused on the companies hired for implementation of infrastructures projects. These companies are linked within conditions of the contract which require vetiver system as an alternative to traditional engineering solutions, often very expensive for embankment protection (such as riprap masonry, coating concrete etc). These conditions of contract requiring the use of vetiver system have greatly opened doors to widespread vetiver utilization within infrastructures projects.

3. RESULTS AND DISCUSSION

3.1. Private sector involvement in the supplying of vetiver

In Congo-Kinshasa, CLIF-IRM-USAID is a pioneer project which has enabled installation of approximately 100 community nurseries, covering more than 4 hectares of vetiver, at least 2.5 million of vetiver slips produced between 2004 and 2006.

Since, a surge in local nurseries took place following the interest and demand from various projects of other partners such as the BTC (Belgian Technical Cooperation), Sogea-Satom (Vinci Construction group), OVD (Office de Voiries et Drainage), Malta Forest etc. These several demands of vetiver have created vetiver business in Kinshasa and surrounding, Bas-Congo (villages between Kinshasa and Mbanza-Ngungu city) and Bandundu provinces (villages and cities between Kinshasa and Kikwit, along over 500km of RN1, these businesses have enabled local people to diversify their sources of income by supplying vetiver slips.

Actually, hundreds of millions of vetiver slips are still available, that means there is no problem in terms of vetiver availability along Bas-Congo-Kinshasa-Kikwit axis and surrounding area. Many of vetiver clumps are cultivated in the borders of residential plots.



Photo 1. Nursery along residential plot borders at Kikwit (Congo-Kinshasa)



Photo 2. Nursery along residential plot borders at Lusanga (Congo-Kinshasa)



Photo 3. Nursery along residential plot borders at Brazzaville (Congo-Brazzaville)

In Congo - Brazzaville during the advocacy and persuasion phase, a number of vetiver has been found in south suburbs of Brazzaville, in Kinkala town and surrounding. This initial quantity of vetiver was used first for implementing demonstrations from 2008 to 2009.

However, the increase of this initial quantity has been noticed with these first vetiver demonstrations for erosion control projects because of the dawning vetiver business. Indeed, local people began not only to develop new nurseries for sale, but also planting vetiver along their plots, especially on suburbs of Brazzaville and its surroundings. This expansion of planting vetiver along the plots has enabled the rise of spontaneous nurseries and has created a sustainable vetiver supply at Brazzaville suburbs for erosion control projects.

The apogee of supplying vetiver slips in Congo-Brazzaville took place within 600 km Pointe-Noire to Brazzaville highway project since 2011. Egis-international (the French consultant engineers project) and DGGT (the project owner), encouraged by successful achievements of erosion control projects in Brazzaville, require the contract of the highway project, the integration of vetiver system for certain Drains, slopes and embankments protection.

Considering 15 millions vetiver slips as initial needs for this highway project, vetiver offers from Brazzaville, Kinkala and its surroundings could not meet this huge demand. Therefore, CSCEC (China State Construction Engineering Corporation LTD, which is the company in charge of implementation of this highway project, decided by common consent with Congolese government, to source vetiver from China, 10 hectares of nursery in Nkayi city, 1.5 hectares in Ngamazabala village and 2.5 hectares in Boulankyo village, with expected production over 25 million of vetiver slips.



Photo 4: 10 hectares of vetiver nursery at Nkayi



Photo 5: 10 hectares of vetiver nursery at Nkayi

In the Uganda Republic the opposite occurred, a part of vetiver slips planted for demonstrations was sourced from Busenyi city and surroundings. Femisa International, the company in charge of vetiver demonstrations, hired a group of nurserymen at Busenyi for vetiver production. Tens of thousands slips were produced for demonstrations on slope section of the road from Fortportal to Bundibungyo cities and Soroti.

3.2. Inventory of partners involved in vetiver projects and number of vetiver slips used

Table 1. Projects using Vetiver System and partners involved in between 2003 and 2014 in Congo - Kinshasa, Congo - Brazzaville and Uganda

Countries	Years	Projet identification	Source of funds	Partners involved	Companies or organism in charge of work	Approximate number of vetiver slips used
Congo-Kinshasa	2003-2006	CLIFS	USAID	IRM/TVNI	TVNI	300.000
	2007	RNI axe Kinge-Masimanimba	World Bank	BCMI/GAUFF eng./Office de Route	SOGEA SATOM (groupe Vinci construction)	1.000.000
	2004-2008	Lutte anti érosive site dreve de Selembao	World Bank	BCMI/Egis-Bceom/OVD	Hydromulch/ Malta forest	500.000
	2014 to date	GIRE	United Nation Environment Program (Unep)	UNEP/Ministère de l'environnement et développement durable	AUBRL	30.000
Congo-Brazzaville	2008-2010	Lutte contre l'érosion site de Casis	Congo-Brazzaville Government	Egis-International/DGGT	Andrade Goutierez	900.000
	2008-2013	Lutte contre l'érosion site de Boukeni	Congo-Brazzaville Government	Egis-International/DGGT	Andrade Goutierez	450.000
	2009-2013	Lutte contre l'érosion site de Pylône	Congo-Brazzaville Government	Egis-International/DGGT	Andrade Goutierez	400.000
	2009-2013	Lutte contre l'érosion site de Mimi	Congo-Brazzaville Government	Egis-International/DGGT	SGC (Vinci construction Group)	600.000
	2011 to date	Construction de la RN1 entre Pointe-noire et Brazzaville	Congo-Brazzaville Government	Egis-International/DGGT	SCEC	30.000.000
	2014 to date	Dédoublement de la RN2	Congo-Brazzaville Government	Egis-International/DGGT	SCEC	150.000
	2014 to date	2è sortie Nord de Brazzaville	Congo-Brazzaville Government	Egis-International/DGGT	COLAS	80.000

	2014 to date	Requalification de la route de la Corniche à Brazzaville	Congo-Brazzaville Government	SGI/DGGT	RB	80.000
	2014 to date	Lutte contre l'érosion site d'Emeraude	Congo-Brazzaville Government	Egis-International/DGGT	Andrade-Goutierez	200.000
Uganda	2013	Bundibugyo road slope protection	DFID	UNRA/GAUFF eng./CICO /FEMISA-International	FEMISA-International/	50.000

In Congo-Kinshasa, Vetiver System (VS) was implemented for CLIFS project in order to show up its effectiveness in bioengineering. About 300,000 vetiver slips were planted for both erosion control and rural road slope protection.



Photo 6. Ravine reshaping



Photo 7. Newly planted Vetiver



Photo 8. Panoramic site view after completed work



Photo 9. Ravine stabilized 4 months later



Photo 10. Ravine totally stabilized 4 months later 12 months later



Photo 11. Planting vetiver for fill batter stabilization



Photo 12. Same site 6 months later, completely stabilized

The successful results of these VS demonstrations especially for erosion control at Kikwit city as shown by above photos, have played a major role in the adoption and expansion of this green technology, with involvement of certain agencies such as the BTC (Belgian Technical Cooperation), in continuing erosion control activities and expansion of vetiver nurseries, without any intervention of TVNI, the initiator of the project.

At Kinshasa City however, the erosion control project on Drève de Selembao site has enabled the export of vetiver system into Congo-Brazzaville since 2008, thanks to Egis-Bceom International which was the project consultant engineer in both countries. The success of vegetation cover restoration on more than 11 hectares using vetiver and hydroseeding on this project is shown on photos 13 to 16 below.



Photo 13. Drève de Selembao erosion control site before vetiver planting and hydroseeding



Photo 14. Same site 2 years later, after vetiver planting and hydroseeding



Photo 15. Drève de Selembao erosion control site before vetiver planting and hydroseeding



Photo 16. Same site, after vetiver planting and hydroseeding

In Congo Brazzaville, erosion control projects were pioneers in integrating VS bioengineering techniques into conventional engineering methods for erosion control at the Casis site, where more than 40,000 m² were covered up by at least 900,000 vetiver plants.

The successful achievement of this integration on Casis site, as shown on photos 17 to 20 below, has widely opened the doors to large scale utilization of vetiver system into all similar erosion control projects, such as at Boukeni erosion site (photos 21 and 22) with at least 450,000 vetiver slips planted, at Mimi site (photos 23 and 24) at least 600,000 vetiver slips planted and at Pylone site (photos 25 and 26) at least than 400,000 vetiver slips planted.



Photo 17. Casis erosion control site at Brazzaville, before planting vetiver



Photo 18. Casis erosion control site, 17 months later



Photo 19. Casis erosion control site at Brazzaville, before vetiver planting



Photo 20. Casis erosion control site, 17 months later



Photo 21. Vetiver planting on Boukeni erosion control site at Brazzaville



Photo 22. Boukeni erosion control site, 12 months after planting vetiver



Photo 23. Mimi erosion site at Brazzaville before vetiver planting



Photo 24. Mimi erosion site, 12 after vetiver planting



Photo 25. Pylône erosion site at Brazzaville before vetiver planting



Photo 26. Pylône erosion site, 12 months later

Since works were completed at all these above sites, a sustainable protection and stability have taken place since and so far no further erosion is reported on any of these four sites.

In 2015 the Emeraude erosion control site has shown outstanding achievement: civil engineering works began just last year. Vetiver planting began on slopes on which reshaping was completed. At least 200,000 vetiver slips are estimated to be planted for this new erosion control project.

In road batter stabilisation projects side, the highway construction project from Pointe-Noire to Brazzaville towns, with about 600 km length, is the biggest project using vetiver system with in at least 30 million vetiver slips needed, never done before in this country and its neighbors.

More seriously the topography of the project path requires large volumes of earthworks,

which left a large number of bare slopes, more vulnerable to water erosion as shown on Photos 27 and 28 below.



Photo 27: Water erosion on RN1 slope at Congo-Brazzaville



Photo 28 Water erosion on RN1 slope at Congo-Brazzaville

In order to reduce the protection cost on these eroded slopes, VST was chosen as an alternative ecological solution, sustainable and lower cost, despite CSCEC, the Chinese company in charge of the implementation of this highway project, would like to carry out very costly solutions which could reward more works and profit.

Photos 29 to 32 below show how slope protections are successfully performed by planting vetiver.



Photo 29. Eroded slope of Congo Brazzaville highway



Photo 30. Planting vetiver on highway slope at Congo-Brazzaville



Photo 31. Congo-Brazzaville highway slope protected, 6 months after planting vetiver



Photo 32. Congo-Brazzaville highway slope protected, 12 months after planting vetiver

Other outstanding road projects are also using Vetiver System for slope protection, among them is the duplication of RN2 project, with at least 150,000 vetiver slips (Photo 33 and 34). The 2nd North exit of Brazzaville project and the Corniche Road project are also using a limited quantity of vetiver, with at least 80,000 vetiver slips each project.

The effectiveness of VST for road batter protection has been confirmed and proven in Congo Brazzaville road projects as a cheaper alternative, more efficient and more sustainable for project owners and consultant engineers, which provide huge financial savings, compared to conventional hard structure engineering solutions, which are too expensive to implement .



Photo 33. Planting vetiver on RN2 slope at Congo-Brazzaville



Photo 34. RN2 slope at Congo-Brazzaville, 4 months later

In Republic of Uganda, the road batters from Fortportal and Bundibugyo towns are highly threatened by water erosion. These degraded slopes remained unprotected by CICO (Chinese company in charge of this road project implementation), as shown on Photos 35 and 36 below.



Photo 35. Slopes erosion on road from Fortportal to Bundibugyo, Uganda Republic



Photo 36 : Slopes erosion on road from Fortportal to Bundibugyo, Uganda Republic

Estimated 50,000 vetiver slips were planted on approximately 5000 square meters of slope for a demonstration site, to prove the effectiveness of vetiver system as a sustainable solution for addressing these kinds of problems. (Photos 37 and 38).



Photo 37. Planting vetiver on eroded slopes of road from Fortportal to Bundibugyo, Uganda Republic, august 2013



Photo 38. Slopes of road from Fortportal to Bundibugyo totally protected, 5 months later

The successful results of this demonstration, as shown on photos 38 above, have enabled the adoption of Vetiver system by UNRA. Certainly future expansion all over provinces of the Republic of Uganda will not be delayed.

Table 2. Number of projects, companies or organisms involved and quantity of vetiver slips planted from 2003 to 2014

Countries	Number of Projets	Number of companies /Organisations	Quantity of vetiver slips planted
Congo-Kinshasa	4	15	1.830.000
Congo-Brazzaville	9	8	32.860.000
Uganda	1	5	50.000
Total	14	28	34.740.000

In Congo-Kinshasa, the above table shows that from 2003 to date, four known projects have used vetiver system, with at least 1.83 million vetiver slips planted, and 15 partners involved in implementation.

The successful results of these projects have positively influenced the adoption and expansion of this green technology through these different partners elsewhere in Congo-Kinshasa. Sogea-Satom which is a construction company, has continued using vetiver system for its road rehabilitation project from Mbankana village and Kwango Bridge, with funding from the European Union in 2009. The Belgian Technical Cooperation (BTC) projects for erosion control have also used VST in Mbunji-Mayi and Kikwit towns from 2010 to 2011. This amply demonstrates that VST has been totally adopted as various partners continue using it without any additional advocacy or intervention of TVNI members.

In Congo-Brazzaville, nine projects involving eight private organisations are using VST with at least 32.86 million vetiver slips produced or planted since 2008 to 2015. With this record Congo-Brazzaville is certainly, the only country in central Africa which has used this enormous quantity of vetiver slips in road and erosion control projects.

This rapid expansion is probably due firstly to the successful advocacy actions with DGGT which is a technical service of the Presidential office in charge of major infrastructure projects. Secondly, the successful of small-scale demonstrations of VST, which convinced

DGGT to adopt the integration of VST and impose this adaptation to all contracts for all infrastructure and erosion control projects.

Several projects presently are using vetiver throughout Congo-Brazzaville. The availability of vetiver slips from local suppliers is no longer concern in this part of Africa, because of the proliferation of nurseries.

In the Uganda Republic, although only one vetiver demonstration project has been conducted, in which five partners were involved and at least 50,000 vetiver slips were planted, the successful result of this vetiver demonstration project enabled UNRA to extend its use in all road projects, for slope protection in the country.

To date, some projects have been carried out which VST has been integrated into conditions of contract in order to address slope erosions problem.

4. CONCLUSION

The main objective of this article is to share experience gained from the introduction of VST into Congo-Kinshasa, Congo-Brazzaville and Uganda. This initiative is not always easy because of uncertainty on the side of project owners, who often are not quickly opened to the adoption of what is considered as unknown technology. In addition, simplicity of its implementation and its relatively low cost remain major handicaps with construction companies which prefer expensive solutions.

Facing these double challenges, the introduction and adoption of VST by public or private potentially new users must obey a certain approach, including advocacy toward policy makers and companies, the establishment of small-scale demonstrations and vulgarization or expansion of demonstrations results.

The successful results of these demonstrations are the unique key that can break the barriers to expansion or the large-scale use of vetiver system. This paper clearly demonstrates that this approach has been successfully implemented in Congo-Kinshasa, Congo-Brazzaville and Uganda Republics between 2003 and 2014, where VST is in a rapid expansion phase in this part of Africa. The transfer of this green technology has been successful done, with at least 13 projects, involving 28 partners and ***about 34,540,000 vetiver slips planted so far.***

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