



Development and Innovation of Urban Rail Transit Vocational Education in Sub-Saharan Africa: a Case Study of Addis Ababa Light Rail Transit

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Abstract: Education is the fundamental task for a country. Higher education even plays an extremely important role in the country's economic and social development. As an African country, no matter economically developed or backward, the urgent task is to attach importance to the development of higher education. However, restricted by the economic and political development status in Sub-Saharan Africa, there are still a lot of problems in the higher education of Africa. Whereas the smooth opening and operation of the Addis Ababa light rail project (AALRTS) in Ethiopia not only fills the blank of rail transit in Ethiopia and African continent, but also breaks through the zero output of rail transit operational management training from China. The success of the training project poses a benchmarking effect on the overseas output development of China's rail transit. In this paper, taking light rail training of Shenzhen Metro in Ethiopia as an example, an analysis is made on the problems in the current vocational education development of Africa and the practice and innovation in this training.

Keywords: urban rail transit, vocational education, Africa, Addis Ababa Light Rail Transit

1. The status of vocational education development in Ethiopia

In contrast to traditional higher education, vocational education is treated as one of the key works of government by the ruling party of Ethiopia to improve the national cultural quality and cultivate technical talents. In order to better promote economic development and develop human resources, the Ethiopian government promulgated and implemented a number of vocational education reform and development related policy documents, such as the "Development Framework and Action Plan" (2001-2010), the "Vocational and Technical Education and Training Declaration" (2004), the "National Vocational and Technical Education and Training Strategy" (2008), the third "Five-Year Plan for Educational Development" (2005) and the fourth "Five-Year Plan for Educational Development" (2010), where many clauses in the documents emphasized the crucial role of education and training in promoting equality and eliminating poverty. Driven by those education policies and development plans, the vocational education in Ethiopia has achieved unprecedented development.

However, the people's response to vocational education is moderate even with the high-profile support from the government. In order to turn the achievements of vocational and technical education into actual driving force for economic development, Ethiopia still faces a series of challenges, mainly including insufficient student resources, insufficient resources in vocational and technical schools, and employment difficulty.

First is insufficient student resource. This is the biggest challenge faced by vocational and technical education in Ethiopia. Due to lacking cognition of vocational education and the influence of traditional culture in the society, many parents are reluctant to send their children to vocational schools for worrying about their children being despised by the society, just like the previous craftsman. Second is insufficient resources in vocational and technical schools. This is mainly reflected in the limited teaching facilities, the lack of learning materials, and unqualified teachers. In addition, the quantity and scale of vocational schools cannot be compared to ordinary education schools. Due to the shortage in resources and subjective preferences, students and their parents view vocational and technical education unfavorably, which directly affects the participation rate and completion rate of such education project.

Third is employment difficulty. Although the rapid economic development in Ethiopia has driven the development of labor market, the employment opportunities for students graduated from vocational and technical schools are still not optimistic, especially for employment in normal sectors. As presented by officials from Addis Ababa Vocational and Technical Education Department, most of such students blindly take up the occupation in non-normal industrial sectors upon graduation to make for a living or support family. Nevertheless, up to now, relevant departments have not yet formulated detailed solutions to help those graduates who are eager to find a job.

2. Challenges of vocational education in Sub-Saharan Africa

2.1 Serious lack of teacher

In African countries, college teachers are paid non-competitive low wages due to insufficient national investment in education. As a result, a large number of existing faculty and staff turn to work in enterprise and governmental sectors and a lot of students graduated from local universities are not willing to stay and teach in their school but accept the offers of enterprises. Even, the excellent students and teachers being dispatched to study in foreign countries are reluctant to return to teach in the country after graduation. Moreover, the capability of local universities in cultivating masters and doctors also goes downhill. Consequently, the number of teachers in colleges and universities of Africa becomes seriously insufficient and its increase is far from keeping up with the increase in the number of freshmen. The ratio of the number of teachers to that of students in some universities even reaches 1:100.

2.2 Disconnection between school teaching and actual needs of enterprises

Due to high price and shortage of supplies, the textbooks currently adopted in African colleges and universities are those that had fallen into disuse in European and American countries many years ago and been far behind the development pace of the times. The teaching content remains at the level 10-20 years ago, which is completely out of touch with the rapid economic development in Africa so that foreign-owned enterprises and domestic enterprises in African countries cannot directly recruit local graduates but spend a lot of time and money teaching them basic knowledge to be acquired in undergraduate stage and even senior high school stage. For this reason, local people can only engage in the most basic and low-level jobs, while the jobs at higher level are occupied by foreigners. Meanwhile, the low quality of college graduates seriously restricts the development of local industrialization.

2.3 Insufficient learning time for students

Since entering the 21st century, higher education in Africa is no longer only enjoyed by royal family and nobles but also be available for students from all walks of life. However, restricted by the economic conditions, most of the students with poor economic conditions also need to do a lot of housework, farm work and part-time job except study. Besides, due to the weak infrastructures, regular power failure, insufficient teaching facility allocation and other factors, students' normal learning time everyday cannot be guaranteed.

2.4 Outdated teaching facilities and low IT application level

Constrained by insufficient governmental investment in education, the number of netizens in Africa is small compared with other continents. A large number of students do not have money to buy computers, and universities also do not have enough funds to buy enough computers. In this circumstance, the level of information technology (IT) application in teaching is extremely low, teaching disconnects with the internet age, and students' computer use rate and proficiency are quite low. For engineering majors with strong practicality, there is lack of necessary laboratories and practical tools and instruments so that students have no opportunity to practice.

2.5 Serious inequality in educational opportunities

Gender equality problem is always a trouble in the healthy development of higher education in Africa. There is still significant gender difference although the governments of countries in Africa have made many efforts in relieving the gender inequality and improved the percentage of females receiving higher education to some extent for many years. In higher education, females lag males in the fairness of educational starting point, educational process and educational results, and there is even serious gender imbalance in some majors and disciplines. In terms of the enrollment in higher education, the number of females is much lower than that of males. In the educational process, the dropout rate of females is higher than males. And there is also considerably large difference between the graduation rates of females and males.

2.6 Lack of professional technical disciplines in rail transit industry

Although Ethiopian government vigorously develops vocational and technical education, it lacks foresight in the training of talents for rail transit industry. Among the 1,300 vocational and technical education institutions, few of them specially provide training for the types of technical work in rail transit industry. Therefore, all AALRTS employees lacking rail transit industrial theories and technologies. Whereas in China, 3-5 years of professional training in rail transit is commonly provided. Hence, it is no surprise that the Ethiopian employees cannot meet the enterprise's requirement in professional theory and skills, although nearly 200 Ethiopian employees engaging in light rail technical work had been sent by Ethiopian Railway Company to Tianjin University of Technology and Education for a 10-month professional training in rail transit before the opening of the Ethiopian light rail.

3. Practice and innovation of Shenzhen Metro's training in Ethiopia

3.1 "Sending-out and inviting-in": breaking the predicament of insufficient teaching capacity in Africa

To solve the problems in Ethiopia like insufficient teachers and lacking teachers majoring in light rail major, Shenzhen Metro adopted the method of "sending-out and inviting-in", that is, sending experts to African schools for providing training and inviting Ethiopian students to come to Shenzhen for receiving skill training. This breaks the predicament of insufficient high-tech professional teachers in Africa.

At the beginning of the operation preparation period in 2015, Shenzhen Metro dispatched 182 high-level technicians and experts to Ethiopia for providing at least one year of professional technical training. The 182 personnel were selected from various professional technical positions about light rail operation in Shenzhen Metro and have many years of practical experience in the positions. And the total learning time provided in the training exceeded 40000h. Hence, the local training effect and quality in Ethiopia were guaranteed.

3.2 Inviting Ethiopian students to China for receiving skill training

Classroom teaching is far from enough to meet the knowledge requirements of high-skilled positions. Therefore, Shenzhen Metro specially invited 200 Ethiopian students and technicians from different specialties and departments of AALRTS to visit and study in Shenzhen, China.

The training for technicians lasted for one month and that for managers lasted for two months. Both of the trainings were conducted in forms of centralized teaching and site visit. In terms of centralized teaching, Shenzhen Metro dedicatedly arranged various professional senior training instructors to give lectures, systematically explained the use, management and maintenance of advanced management equipment and key equipment for metro operation such as rail transit dispatching control center, vehicle center, communication center, and ticketing center, and comprehensively displayed its achievements on operation and development of Shenzhen Metro. In terms of site visit, 56 Egyptian trainees were arranged to learn and experience the passenger service work at Luohu Station, Convention and Exhibition Center Station, Buji Station, Laojie Station, Futian Station and other stations during the training.

3.3 Combination of theory and practice: breaking the dilemma of disconnection between school teaching and the enterprise's actual need

Over an in-depth investigation, Shenzhen Metro found that the basic knowledge of local college graduates was very weak, and the knowledge acquired was also too outdated to meet the requirement of actual work relevant to light rail. In face of this problem, Shenzhen Metro actively made clear the actual theoretical levels of local graduates in each major by investigation and formulated a targeted "plan for training of Ethiopian personnel in Shenzhen" instead of dispatching more Chinese employees to Ethiopia to replace their positions. This plan created a theoretical knowledge replenishment plan tailored for each major and provided the Ethiopian personnel with college-level theoretical knowledge training.

After completing the basic theoretical knowledge training, the Ethiopian personnel began to complete the pre-job professional theoretical training on light rail technology one by one in accordance with the training system of Shenzhen Metro. Each trainee was required to receive at least 3 months of theoretical training, and the average time spent in studying theoretical knowledge exceeded 100 h.

3.4 Highlighting practice-oriented teaching to improve practical work ability

In addition to theoretical teaching, Shenzhen Metro also scheduled practical training taking more than half of the total learning time under the training plan, arranging the trainees to follow Chinese employees working on site to enhance the practical use of theories and help them quickly and better master the actual working skills.

Especially, Shenzhen Metro strengthened the practical training of drivers, dispatcher, maintenance, and other more practical types of work. Each trainee averagely had more than 100 h of practical training. Over one-year combined cultivation in theory and practice, most of the trainees had passed the theoretical and practical examinations, obtained corresponding qualification certificates, and possessed the ability to work independently.

3.5 Promoting school-enterprise cooperation for joint cultivation of high-quality and skilled talents

Shenzhen Metro introduced the school-enterprise jointed school running model in Shenzhen to Ethiopia and established a school-enterprise cooperation model with Ethiopian characteristics to promote mutual benefit and win-win from light rail projects. Ethiopian Light Rail Company established cooperative partnership with Higher Education Department and Vocational Education Department, the Ministry of Education of Ethiopia, and developed school-enterprise cooperation

with ten top universities in Ethiopia including Addis Ababa University, Addis Ababa University of Technology, Adama University, Adama University of Technology, Mekelle University, and Aksum University. Moreover, school-enterprise combined training base was also set up in light rail vehicle depot to provide practical learning opportunities for excellent students majoring in electrical affairs, mechanics, computer, and so on from the ten top universities.

3.6 Increasing investment in modern teaching equipment to improve the IT application level

To improve the quality and IT application level of the training, Shenzhen Metro decided to introduce internationally advanced passenger train driver simulator and placed it in the vehicle depot. All the buttons and instruments on the simulator console are no different from those on the real train. The real-time record and display of the situations of all lines on the front screen can give people an immersive experience. In this driver simulator, new driver will encounter with dozens of emergency situations such as rail failure, vehicle failure and collision of trains. By using this device, new driver can complete the intensive training before normally taking the job and master the methods for dealing with such emergency failures to ensure the safety of passengers.

3.7 Practically fulfilling the enterprise's social responsibilities and providing employees with equal learning opportunities regardless of gender

There is still serious gender discrimination in African countries. Females can hardly enjoy the same right to study as males. In colleges and universities of Ethiopia, female students are far fewer than male students. Their parents do not allow them to work outside. In this circumstance, even if they want to study, they must break through numerous obstacles.

Against the traditional sex discrimination in Africa, Shenzhen Metro provided males and females with equal training opportunities. In the training, totally more than ten Ethiopian female drivers for light rail train were cultivated and invited to receive training in Shenzhen. Besides, more than 300 female ticket sellers and more than 50 female ticketing inspectors were also cultivated. This way promoted job equality, broke the gender discrimination, and gave every employee equal opportunity to learn.

4. Conclusion

As the Ethiopian government constantly increases investment in education, the pace of education reform has accelerated, and various types of education at all levels have been developed rapidly. In order to adapt to the rapid economic development, Ethiopian government even puts the development of vocational and technical education on the agenda. Driven by a series of educational policies, Ethiopia's vocational and technical education has made significant progress in aspects of school-running institutions, enrollment numbers, funding, and teacher resources. However, there is still huge market blank in terms of vocational and technical education in rail transit.

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