Part II

Science and Technology in Education

4

Educational Policies and the Under-Representation of Women in Scientific and Technical Disciplines in Niger

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Introduction

The issue of insufficient access to education and training in science and technology was the second point in the platform developed by African women at their preparatory conference held in Dakar before the Beijing Conference.[1] Today, more than a decade later, women's access to education remains a concern, and shocking statistics keep this issue among the top priorities, not only for the independence of African women, but also for the goal of sustainable development on the continent.

Thinking about women's access to scientific knowledge in Africa generally follows a deterministic approach that stresses the biological, psychological and social factors affecting girls' behaviour within the educational infrastructure available to them (Erinosho 1994). Using the example of Niger, this chapter will attempt to show how the available school infrastructures, the prevailing issues at the time of their creation and the ideologies underlying girls' access to education affect their choice of an area of specialisation. This study presents the under-representation of girls in schools in general, and in the scientific disciplines in particular, not as a result of their constitution or of some biological inability, but as a social construct (Imam 1997; Harding 1999).

This chapter is organised around two main ideas. The first is that, despite their apparent gender neutrality, educational policies have an impact on girls' access to scientific and technical education. The second is that the under-representation of women in scientific study courses is an obstacle to development; it guarantees the

reproduction of the cycle of gender-linked inequality by maintaining women in a situation of socio-economic dependence.

In Niger, the educational system has three levels: primary (elementary school), secondary (middle school and high school) and post-secondary (university and other post-secondary educational facilities). An area of specialisation is only chosen after the BEPC, that is, after a minimum of years of schooling.[2] Analysis of the conditions of women's access to scientific education raises questions regarding the access of girls to basic education as well as their performance (UNESCO 1994; Beoku-Betts 1998; Abder and Mehta 1999; Ka 2001), which respectively involve the phenomena of 'under-schooling' and 'poor schooling' to which they are subjected (Ki-Zerbo 1990).

Indeed, the overall enrolment rate of children in Niger, estimated at 30.3 percent, is very low. As well as being characterised by sizeable gaps between girls and boys on the one hand and rural and urban areas on the other hand. Although women represent 50.4 percent of the 10.8 million inhabitants of Niger, the number of girls in educational facilities is consistently lower than the number of boys. In 1990, for instance, they made up only 36.1 percent of the school population at the primary level. This figure rose to 38.6 percent by 1998 and has reached nearly 40 percent today.[3]

However, the increase in the number of girls in school, so often touted by officials as the culmination of their efforts, is misleading, as it does not provide sufficient information about the alarming trend in the number of girls outside the education system. In 1990, the enrolment rate in the general population of girls between the ages of 6 and 11 was estimated to be at only 14.6 percent, as compared to 28.48 percent for boys in the same age group (UNESCO 1994). Moreover, out of 100 new girl pupils in the first year of primary school, only fifteen continue through to the last year of secondary school (as compared to twenty-nine boys), while only one makes it to the end of a university programme. Moreover, technical education is offered in less than two percent of educational facilities, and girls make up barely a quarter of the students (Hamani 2000).

The study on which this chapter is based attempted to identify the political and institutional causes of this under-representation of girls through a critical analysis of the actions and strategies adopted by the government of Niger in its regulation of the education system. Since the government has in recent years been highly dependent on external financing, our study would not be complete without an analysis of its relations with international actors, such as the World Bank, in the context of the application of structural adjustment plans (Stromquist 1998). Consequently, educational policies will be considered not only as a factor that influences the behaviour of the population towards educational institutions, but also as a product of the interactions of political actors within the government of Niger on the one hand and between them and international financing institutions on the other hand.

Furthermore, by presenting equal access to technical and scientific education as one of the principal means of promoting both the socio-economic integration of

women and sustainable development, our study posits knowledge in general as an instrument for the promotion of justice and equality. It also recognises the scientific and technological foundations of development. Thus, beyond the analysis of the conditions of girls' access to scientific and technical knowledge, our study aims to assess the efficiency of scientific and technical education—and its capacity to promote equality and development in Africa—through an examination of scientific and technological research and innovation in the socio-cultural context of the situation of women in African countries. Consequently, from the perspective of 'standpoint theories' (Harding 1991, 1993, 1998; Beoku-Betts 2003), it is important to discover what issues and interests are predominant in the creation, legitimisation and distribution of scientific and technological knowledge. What science and what technology are needed in Africa, and for what type(s) of development? And what role can or should women play in the process?

In order to answer these questions, this study relied on documentary research supported by data gathered in the field in Niger in 1997 and 2003.

In the rest of this chapter, I will first attempt to demonstrate, from a historical perspective, how educational policies from the colonial period up to now have created an environment that dissuades girls from studying science and technology. I will then outline the impact this 'masculinisation' of scientific and technical knowledge has had on the socio-economic and political development of women and their societies.

Colonial Education Policies

The role of colonial education policies in the under-representation of women can be seen in both the relative lack of space given to scientific education in colonial schools at the time of their creation and by the fact that the colonial education system stressed the differences between the sexes.

Lack of Emphasis on Science in Colonial Schools

The education policies instituted by the colonial powers in Africa were not focused on transferring knowledge to colonised peoples to enable them to understand, transform and control their environment but to train managers capable of ensuring the proper running of the colonial administration. As the project of schooling the youth among the colonised peoples was essentially aimed at satisfying colonial objectives, the education system evolved along with the needs of the colonial administration. In the French colonies, for instance, the need for interlocutors and the objectives of assimilation contributed to the development of a highly theoretical education, mainly emphasising the mastery of the French language and an understanding of the history of the colonial power. The first school in French-speaking Africa dates back to 1807, but it was not until 1906 that serious discussions were held regarding technical education (Meunier 2000). Professional schools were developed many years after schools with a general educational focus and remained few in number, reserved for a handful of privileged youths who were restricted to an education aimed at preparing

them to work in health care, post offices, telecommunications, farming, public works, etc.

The scientific and technical knowledge introduced into Africa at that time was elementary. Despite this, imported techniques and technologies could be described as modern compared to those that were used during the pre-colonial era. However, once again, they were not so much aimed at the development of the local populations as at the successful exploitation of raw materials. Ill-suited to the social and ecological realities of certain pre-colonial societies, imported technologies imposed themselves by disqualifying local knowledge and the balance which it had attempted to maintain up until then between people and their environment (Shiva 1993). These strategies go a long way to explaining the limited development of scientific and technical education in Africa and the 'schizophrenic dichotomy' (Ki-Zerbo 1990) that can be observed between this type of education and the social, cultural and economic realities of Africa.

Colonial Schools and 'Masculinisation' of Knowledge: The Introduction of 'Girls' Studies'

Traditionally, women played a very important role in the production and distribution of traditional scientific and technical knowledge in Africa. However, in the colonies, the education of young girls was distinctly delayed compared to that of boys. As the colonial powers did not initially see a need to use African women in their colonisation efforts, the first girls' school in French West Africa (*Afrique Occidentale Française* or AOF), founded in 1819, was reserved exclusively for European and mulatto girls (Djibo 2000). In Niger, girls' schools only began to be developed a century later, in 1914. Thus, as Djibo notes:

> …although Ecole Normale William Ponty, a preparatory school for future African heads of state, which brought together the brightest stars from secondary schools throughout French West Africa and provided training for teachers, interpreters and clerks, was opened in 1910, a women's section was only created in 1939. Similarly, the medical school founded in 1918 only received its first classes of midwives twenty years later (Djibo 2000, my translation).

In addition to the fact that they were only able to enter school much later than boys, girls did not have the opportunity to gain access to the little knowledge their brothers were allowed to acquire in those institutions.

Indeed, the ambition the colonial teachers had for African girls was to make them into model housewives and instruments for the transmission and spread of European culture. The education offered to them was essentially aimed at perfecting their status as colonial wives and mothers. The idea that they might eventually make a contribution to public affairs was only envisaged through the education they provided for their children. Georges Hardy, head of the French West African teaching service from 1912 to 1922, summed up the contents and the purpose of girls' education in the following terms:

> When we put a boy in French school, that is one unit; when we school a girl, it is one unit multiplied by the number of children she will have …. When mothers speak French, their children learn it effortlessly and … French becomes quite literally their mother tongue …. [W]e teach them everyday French, a little math and the metric system, purely for application to their household budgets and everyday purchases, but most of their classroom time is devoted to needlework, cleanliness, childcare, hygiene, and housekeeping, and all those lessons maintain a practical, immediately utilitarian character; they are not aimed at developing formulae nor coordinating precepts, they help them develop nimble fingers, and sustain the children's desire for improvement and joy in accomplishing useful work (Hardy 1917, my translation).

Thus, if colonial schoolteachers had finally realised the importance of schooling girls, girl children were assessed only in terms of their contribution to the achievement of colonial aims, and in the light of the prevailing European notions regarding the role and place of women in society. To a certain extent, the developer of the colonial schools merely imported the gender principles of European education systems. Michèle le Doeuff reports that during that era "girls were subjected to a 'girls' education' at the secondary level—not too much science, no Latin, no Greek, no philosophy, but with classes in sewing and home economics" (Le Doeuff 1998, my translation).

Colonial education was thus based on the sexual division of labour that characterised European societies, which adhered strongly to patriarchal principles: 'men were supposed to take care of the economic and political realms, while women were supposed to be responsible for the private realm—the domestic sphere and reproduction' (Mokin 2000, my translation).

Of course, using colonial policies to provide an explanation for the differences between boys and girls in the school system in general, and girls' distance with respect to scientific and technical subjects in particular, does not totally exclude the existence of a gender-based division of labour in pre-colonial Africa. Indeed, it is important to examine the main pre-colonial structures for the transmission of knowledge in order to determine how they dealt with the issue of educating young girls. Did girls receive the same type of treatment as boys in these structures? How did they react to the institution of the new colonial system and, in particular, to its sexual division? Did they develop resistance strategies or, on the contrary, did they cooperate? Such questions urge us to undertake a brief review of the organisation of social relationships between the sexes during the pre-colonial period as well as the role played by women in the mechanisms for the production and distribution of knowledge at that time.

In certain pre-colonial societies in Niger, women's low public profile had less to do with the passive nature that has often been attributed to African women in general, and often wrongly (Djibo 2000; Ki-Zerbo 2003), than with the subtlety of the institutions through which they participated in public affairs (Sherif 1997). Indeed, women in pre-colonial Hausa and Songhai societies played very important roles, both socially and religiously. In Hausa societies, for instance, the positions of

inna, *iya* and *saraouniya* enabled the women who occupied them to participate in the management of the politico-religious affairs of the state. Songhai women were also able to assert themselves in their societies by monopolising the secrets of worship and healing rituals. It can be argued that the gender structure of those societies reflected, in many respects, a complementary relationship (Mama 1997). However, the complementary nature of those relationships in no way precludes their hierarchic nature, nor their patriarchal essence. In other words, even though gender relations in those societies did not reflect a relationship of domination, such as we can observe in some other regions at that time, they were certainly far from being egalitarian. Moreover, the distribution of roles within these societies was based on gender differentiation. Women's activities were linked, directly or indirectly, to their biological function of reproduction, and the food conservation techniques and herbal medicine they mastered were linked to their social functions as educators and guardians of the physical and mental well-being of their offspring.

Educational institutions in those societies were not geographically defined. They were, as Ki-Zerbo pointed out (1990), 'schools without walls' located throughout the community.[4] Indeed, the community as a whole worked according to its own values and standards to teach children to become men and women who would work toward the greater good of all. Girls' education in Hausa societies, as in other precolonial African societies, destined them to take an active role in their societies, but mainly in areas touching on the private sphere. Linda R. Day reports on the education received by girls in Bundu schools in the following terms:

> The aim of education for girls under the auspices of the Bundu society has always been to transform girls into women. […] When girls remained in the Bundu School for up to three years or more, they learned how to fish, cook, weave, spin cotton, dress hair, and make baskets, musical instruments, pots and fishing nets. They learned special songs and dances as well as how to behave within the associational structure of Bundu and other corporate groups that comprised the community. The medicinal use of herbs was another traditional skill taught to Bundu initiates. In general, girls in the Bundu School were taught a variety of skills considered essential for a woman (56).

Methods for socialising girls in accordance with community standards and knowledge did not differ greatly from the ideas conveyed by colonial education policies; they also aimed to prepare girl children for their future roles as wives and mothers, so that they could better ensure the reproduction of their society and preserve its moral integrity. The mistrustful attitude parents adopted towards the colonial educational institutions when they were created, far from being a form of protest against sexist education, reflected their desire to preserve their traditional modes of social organisation. Among the Hausa, the Songhai and many other communities in Niger, and in Africa, the prototype of the ideal woman evokes the image of a fertile woman entirely devoted to her roles as wife and mother, respectful and shy, who stays at home and adheres to the code of honour by preserving her virginity until

marriage. The colonial schools' location outside family institutions was perceived as a threat to the existing social and cultural balance. The fear that girls would abandon their obligations on leaving home to study was one of the main causes of parental hostility towards colonial schools and the formal schooling of girls.

Thus, it can be seen that gender differentiation in the transmission of knowledge was not unknown to pre-colonial Africa. However, since the colonial schools were an institution foreign to pre-colonial African social structures, it can be argued that an education free of any connotations linked to biological differences could well have produced neutral behaviour toward the subjects taught. Thus, by opening its doors to boys first and by providing only a 'domestically-oriented' education for girls, colonial schools did much to strengthen and justify gender differentiation. The fact that only boys had access to scientific and technical education built up the perception that scientific and technical studies were the natural preserve of the male gender. This guided parents as they socialised their children within an institution that was new to them. Because scientific and technical subjects were widely perceived as 'boys' subjects', girls were more or less conditioned to turn to subject areas more 'suited to their nature'. The internalisation of these stereotypes during the socialisation process creates in girls a distaste for scientific subjects and a belief that girls are more suited for subjects closer to the roles traditionally devolved to them. This explains why the majority of girls can still be found in the arts and education faculties. In addition, even within scientific fields of study, girls in university are more often enrolled in health sciences and in agronomics than in mathematics, physics, chemistry or biology. For example, in 1988, they only made up 2 percent of all students enrolled in science, compared to 18 percent in education. These figures had risen to 8 percent and 24 percent respectively in 1991.[5]

Furthermore, girls who resist the socialisation process aimed at confining them to 'feminine' areas of study have difficulty gaining acceptance in male-dominated areas. Their abilities are constantly questioned, even by other women. A study conducted using a sample of twenty women in Nigeria found that only two preferred to be operated on by a woman rather than by a man and only four would like to work under a female supervisor. However, eleven out of the twenty would prefer to seek a woman's advice in the event of personal problems. This situation is not typical of Nigeria alone. While it is growing less common in the West, such attitudes can be found in most other places in the world. At independence, African states in general did not succeed in deconstructing this socialisation process that the colonial schools had greatly contributed to structuring. On the contrary, they not only perpetuated these tendencies inherited from colonisation, but also created conditions that promoted their institutionalisation.

Post-Colonial Education Policies

The education policies adopted in Niger during the post-colonial period were greatly influenced by the political choices made following independence. These choices

shaped not only the content of policy but also the contexts in which policy was designed and implemented. I will outline some of those political choices in order to discern how they not only crystallised unequal access to scientific and technical education between girls and boys, but also strengthened their reproductive mechanism.

Post-Colonial Political Choices

The building of a nation from the disparate groupings inherited from colonisation was one of the major objectives African states set for themselves at independence. This led to the creation of a massive administration through which post-colonial states aimed to control their populations and integrate them into the development process. As early as 1966, in a book entitled *False Start in Africa* (*L'Afrique noire est mal partie* in the original French), René Dumont denounced this phenomenon, describing administration as the top industry in the Third World. Indeed, the attention focused on the edification and management of the administrative system was prejudicial to the development of the industrial sector. The neglect of this sector, which requires workers with scientific and technical training, explains in part the lack of educational infrastructure devoted to scientific and technical training. Girls have been particularly affected by this situation and still form a tiny minority in institutions that were already very few in number. Thus, of the199 secondary schools in Niger inventoried in 1997, only two were technical institutions. And, as we can see from the following table, very few girls were enrolled.

Table 1: Girls' Access to Technical Education, 1986-1992

Year	Boys	Girls	% Girls
1985-1986	546	75	11.2
1986-1987	601	69	10.3
1987-1988	729	63	8.0
1988-1989	798	51	6.0
1989-1990	775	75	8.8
1990-1991	775	74	8.7
1991-1992	554	91	10.8

Source: Statistical Yearbook of the National Ministry of Education

The rates of access of girls to technical secondary education are far from showing progress. The regression, or at the very least the stagnation, that can be observed in higher education cannot be dissociated from the political and economic trajectory of the government of Niger. Indeed, the methods of government observed in most African states, i.e., the lack of transparency in the management of public affairs and the concentration or monopolisation not only of power, but also of state resources, in the hands of a single individual or groups of individuals (Médard 1991; Bayart 1989; Jackson and Rosberg 1982), have created a climate that does not promote the

success of development policies (Mbembé 1992). The inability of post-colonial African states to generate development has bankrupted their economies and made them dependent on international financial institutions (Mkandawire and Soludo 1999). The economic liberalisation demanded by these institutions has led to the progressive withdrawal of the state from public sectors, including education. This has necessitated the adoption of certain policies aimed at restructuring the education system.

Restructuring the Education System: Structural Adjustment and Girls' Schooling

Among the restructuring measures adopted in Niger, two have had particular repercussions on the schooling of young girls and their access to scientific knowledge. These are the establishment of a competition for entry into the civil service and payment by parents of part of the cost of the schooling of their children. The people only began to feel the impact of these reforms in 1990, with the first class of graduates that did not enter the civil service. Parents seriously began to pay for school supplies around the same time.

Before the reforms, young graduates in Niger systematically entered the civil service. This led the population to view state employment as the main purpose of school education and to consider the schooling of their children as an investment for the parents or the group. By introducing a highly selective contest, which became the only means of obtaining a civil service position upon graduation, the state in effect eroded the credibility of education among the population. The growing number of unemployed graduates has accentuated parents' reticence to enrol their children in an institution they increasingly perceive as a 'factory for unemployed people'. Consequently, as Shona Wynd notes, 'schooling is valued not for the basic skills it provides, but for the jobs that students, and their families, anticipate upon graduation. Decreasing job opportunities contribute to perceptions that the time spent learning to read and write is time better spent at home' (Wynd 1995).

Table 2: Enrolment of School-aged Population

Years	Boys	Girls	Difference Boys/Girls
1980	24. 1	13. 71	10. 43
1990	28. 48	14. 60	13. 80
1993	29. 45	14. 55	14. 90
2000	29. 06	14. 40	14. 66

Source: UNESCO, 'L'Éducation des filles et des femmes: par delà l'accès'.

Table 2 enables us to establish a link between the application of these policies and enrolment rates of girls, which rose from 13.71 in 1980 to 14.6 in 1990, but have been falling ever since. At the same time, the gap between the real rates of access of girls and boys to schooling has continued to broaden. Studies in other countries have shown that the correlation between the incomes and social status of parents and enrolment in school seems to be stronger for girls than for boys (Rathgeber 1999; Biraimah 1987; Lebeau 1994). The case of Niger supports that conclusion; the cost-sharing policy seems to be linked to a decrease in the enrolment rate of girls. It should be noted that this measure was introduced at a time when the purchasing power of the parents, which was already quite low, had fallen further and in an environment where the population in general was, as we mentioned earlier, not very convinced that school education was a good idea for girls. Therefore, when their limited means forced them to make a choice of which children to send to school, parents most often favoured their boys. Girls were generally viewed as 'strangers living temporarily with their own families' (Konaté 1992), and since their schooling no longer led systematically to employment, most families deemed it more economically sound to invest in education for their boys. Table 2 above shows that the rate of enrolment among boys continued to progress until 1993, when the girls' enrolment rate recorded its third decrease in a row. By reducing girls' access to basic education, cost-sharing and competition for entry to the civil service together contributed to widening the pre-existing gap between girls and boys in scientific and technical studies. Since basic education is a necessary prerequisite for scientific studies, girls who lack access to school simultaneously lose all hope of acquiring scientific and technical knowledge.

The impact of the cost-sharing and civil-service policies on girls' representation in scientific fields can also be evaluated through the way these two measures affected the path of girls who were already in school. In higher education, new criteria for awarding bursaries were introduced to make it harder for students with humanities backgrounds to get a bursaries and to encourage students to increase their enrolment in the sciences (Issa-Abdourhamane 2000). Since, in Niger, the majority of girls in secondary school enrol specialise in humanities, very few qualify for bursaries. Those who do not have a bursary most often have no hope of pursuing their education and so, bowing to social pressure, turn to marriage. Furthermore, due to reduction in the value of the bursaries, even those girls who choose a scientific major in secondary school are increasingly discouraged from undertaking scientific and technical studies, since the cost of education is higher and their chances of succeeding are slim. Since entering the civil service is no longer a certainty, the argument of private sector hiring practices, which discriminate against women, is also frequently used to dissuade girls from undertaking scientific studies. Consequently, the number of girls enrolled in scientific studies continues to drop, as suggested by the table below.

Table 3: Number of Girls Enrolled in Scientific Faculties at the University of Niamey

School Year	Faculty of Agronomics		Faculty of Science		Faculty of Health Sciences		Total Students Enrolled	No. of Girls	% of Girls
	Girls	Boys	Girls	Boys	Girls	Boys			
2000-2001	49	201	112	1083	345	774	2564	506	19.76
2001-2002	44	247	66	892	335	818	2402	445	18.52
2002-2003	46	253	51	614	293	834	2020	319	15.79

Source: University of Niamey.

Table 3 provides a recent look at women's representation in the scientific faculties at the University of Niamey. The number of girls enrolled in these faculties dropped from 506 during the 2000-2001 university year to 319 in 2002-2003. And yet, over the same period, the number of girls enrolled in the Faculty of Humanities rose from 687 to 1118.[6] This clearly indicates that girls who have completed scientific secondary studies or who have previously studied in a scientific faculty are increasingly enrolling in the Faculty of Letters and Humanities. The drop in the number of girls studying science has serious repercussions for the women of Niger and the country as a whole.

Consequences of the Under-Representation of Women

Scientific and technical knowledge makes it possible to acquire the necessary expertise to make effective use of scientific progress and innovations to improve the living conditions of the population (Okebukola 1995). The fact that girls are increasingly excluded from the process of acquiring scientific and technical knowledge makes it difficult for women to use new technologies. Furthermore, because women cannot do without scientific and technical discoveries, the refusal to expose them to scientific and technical knowledge places them, as Marie le Doeuff has pointed out, in a relationship of indebtedness and dependency towards men as a group (Le Doueff 1998). Concretely, women's inability or limited ability to use new technologies hinders them from increasing the productivity and profitability of their activities, which would give them the economic weight to win their struggles for survival and socio-political integration.

Unequal access for girls and boys to scientific and technical education also poses the problem of the under-representation of women and their interests in the structures that design and implement scientific and technical knowledge. The low number of women in these structures, not only in Niger but throughout the world, certainly explains the fact that 'measures aimed at taking account of women's needs in the design and assessment of science and technology have never produced tangible results' (Karzanjian 1999, my translation). Indeed, scientific and technical projects, which are mostly designed by men, cannot effectively address issues linked to the

physical, emotional and material well-being of women. Thus, as Olaiton (1994) points out:

> If science is about the search for exact knowledge, there is need to obtain exact information about women and their activities in society. At the most reductionist level, getting exact knowledge about oneself cannot legitimately be done better by another person.

The absence of women in scientific research institutions can only lead, as Sandra Harding has said, to 'scientific and technological changes exclusively designed to simplify the lives of men, and consequently unable to generally improve the position of women, nor stimulate sustainable development (Harding 1999, my translation). From this standpoint, the integration of women into the process of acquisition, production and utilisation of scientific knowledge represents an important issue for women and their societies.

In Niger, 80 percent of women work in agriculture. If these women had increased access to scientific and technical training, they would be better able to understand and use new techniques not just to increase their incomesbut also to help their country resolve the chronic food deficit from which it has suffered for several decades. The country's health indicators are also demonstrative of the need to promote women's representation within scientific structures. In 1990, there was only one doctor per 33,000 inhabitants, only 33 percent of pregnancies were medically monitored and only 21 percent of deliveries were attended by a healthcare worker. Life expectancy in Niger, as in many other African countries, is one of the shortest in the world at 45.7 years, and the mortality rate, at around 20 percent, is also one of the highest. In Niger, women's and children's health is among the most vulnerable in the world. This situation, which reflects both the low level of scientific and technological development in the country and women's exclusion from the process of design and implementation of health programmes, cannot be reversed as long as girls do not have equal access to health training and education. Indeed, since the impact of poor sanitary conditions affects women more than any other segment of the population, it would be wiser and more effective to provide them with the necessary knowledge to influence mechanisms for the identification, assessment and resolution of health problems. This would lead not only to demographic change (Kazanjian 1999), but would also promote the spread of scientific values within African societies in general:

> A young female science student of today is a scientist of tomorrow and at the same time a potential mother and teacher. If she imbibes the traits and attributes from learning science meaningfully, she will most likely pass some on to her children (Azeke 1994).

Thus, through their attachment to the local environment and their decisive role in the process of socialisation of children, women can promote the emergence and spread of a scientific and technological culture adapted to the social context in Niger in particular and in Africa in general. This is especially important because the

persistence of underdevelopment in Africa can be viewed as a legitimisation of allegations that science is patriarchal in nature and that technology is an instrument for imperialist exploitation and domination (Shiva 1993; Rathgeber 1999), bringing back to the fore the pressing issue of ownership of imported technologies and their ability to generate sustainable development in Africa (Muntemba and Chimedza 1999).

In this regard, African women can serve as the pillars that hold up the bridge linking modern knowledge to local knowledge. Such a link is the only way to guarantee rational and effective use of imported technologies, but in order for women to fully play this role, they need to be considered not only as receivers but also as creators of knowledge (Appleton et al. 1999). This would mean not only making the acquisition of modern knowledge an imperative for little girls, but also valuing and capitalising on the local knowledge already in the hands of women. This approach would enable African countries to adopt new technologies while maintaining their essence, and respecting their dignity and identity.

Conclusion

Relations structured around gender are complex. On the one hand, their form and breadth vary from society to society and from era to era. On the other hand, Africa is a continent rich in cultural, social and political diversity. Consequently, the present study cannot lay claim to completeness. However, it does provide a look at the political and institutional aspects of the issue of gender, science and technology in one country of the African continent, Niger.

Thus, we have seen that the under-representation of women in scientific and technical studies, which originated in colonial education policies and was perpetuated by post-colonial political choices, remains a major obstacle not only to the social, political and economic integration of African women, but also to the emergence of a process of sustainable development on the continent. Indeed, African countries cannot achieve development while ignoring or under-using the potential of the women who make up more than half of their human resources. They also cannot effectively resolve the issues of famine, ignorance, disease, civil war and poverty if they leave women, who are the most vulnerable members of their population and suffer the most from those scourges, on the sidelines of the development process (Forje 2001).

Women have a very important role to play in the reconstruction of Africa. Through the socialisation process, they can pass on to their children—both boys and girls—a thirst for modern knowledge and a desire to develop traditional knowledge. This will not only stimulate their initiative and creativity, but will also facilitate the emergence and adoption of mentalities and technologies that will promote judicious and productive management and processing of their natural resources, which could lead to development by and for Africans. However, if women are to teach their children to shun handouts and take their future into their own hands, we need to

create the conditions that will enable them to free themselves from the dependency imposed upon them by the patriarchal and imperialistic order (Gordon 1996). To this end, numerous policies must be developed and supported by awareness campaigns with a view to promoting women's integration at all levels of the process of acquisition and production of knowledge.

If we view science as an activity aimed at understanding nature and improving human lives, we can imagine that science must suffer at the way it is used to promote the interests of one group to the detriment of another, as well as the attempts to standardise it to the advantage of certain regions in the world and the detriment of the others. Modern science is the fruit of the accumulation of various types of knowledge coming from all over the world. It should therefore be viewed as the legacy of all mankind. It should not be monopolised by certain capitalistic and geostrategic interests, but should serve all humankind, regardless of gender or regional origins. Modern science is born of diversity and, for it to maintain its essence, we must democratise the conditions of access to scientific knowledge and innovations and create conditions that promote the expression, development and integration of various types of knowledge, so that all nations may see themselves reflected in this universal legacy. Women and men, the West and the rest of the world, 'have different strengths and weaknesses … reflected in the way they see science and technology and solve scientific and technological problems' (Abder and Mehta 1999, my translation). Science must take this reality into account if it is to shed its patriarchal and Eurocentric attitudes, which may be a homage to the laws of the free market but are a disgrace to humanity. Equal integration of women from all regions of the world into the process of acquisition and production of knowledge 'would add not only new subjects, but would also provide an opportunity to re-examine the premises and standards of existing research' (Mokin 2000, my translation).

To return to the specific subject of gender, one question still begs to be answered. Would the disastrous side of science have developed as it has if women had had the opportunity to participate equally in the design and implementation of scientific and technical projects? In light of the proliferation of weapons of mass destruction and the threat they represent for our lives and environment, it can certainly be said that, more than ever before, the scientific and technical world has need of the protective instinct that women have acquired and developed in the domestic sphere.

Equal participation of women in science and technology in Africa and in the world in general is a major issue that requires mobilisation on the familial, national, continental and global scales in order to establish strategies and policies that will contribute to bringing this about.

Notes

1. For an analysis of the regional platforms presented in Beijing, see Annie Labourie-Racapé, *La quatrième conférence mondiale sur les femmes: priorités et enjeux des programm* 'Part I: Science and Technology in Society: Discourse, Perspectives, Practices and Policy es régionaux' in

Genre et développement: des pistes à suivre, documents et manuels du CEPED, n° 5, Dec. 96, pp. 77-95.

2. The Brevet de fin d'étude du premier cycle (BEPC) is obtained after four years of study at middle school.
3. Statistics gathered by the National Ministry of Education, Niamey.
4. However, other societies did have educational structures that could be described as formal. This was the case in communities that had highly structured secret societies for women, which passed on knowledge to their members through clearly established programmes that were dispensed by specially trained individuals. Bundu society, which existed (and still exists) in certain parts of Guinea, Liberia and Sierra Leone, is one of the institutions that Linda R. Day describes as 'classical African preparatory schools'. See Linda R. Day, 'Rites and Reason: Precolonial Education and Its Relevance to the Current Production and Transmission of Knowledge'.
5. Figures from the Ministry of Social Development, Population and the Advancement of Women (MDS/P/PF), Niamey, 1997.
6. Figures gathered at the registrar's office of Université Abdou Moumouni in Niamey, July 2003.

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