Development of the SENAI Post-Secondary Sector in Brazil

David N. Wilson
Ontario Institute for Studies in Education
University of Toronto

Abstract:

The development of non-formal post-secondary institutions to train technicians and technologists by the National Industrial Learning Service, SENAI, is examined and compared to the formal university sector in Brazil. Two of the thirteen SENAI post-secondary training centres received assistance from The Canadian International Development Agency, which included both technical assistance from, and training of Brazilian instructors at, universities and Colleges of Applied Arts and Technology in Ontario and post-secondary institutions in Québec. SENAI is the world's oldest National Training Board and has augmented its practical training systems since its creation in 1942. The development of post-secondary technician and technologist training, plus a polyvalent model of research for and assistance to industry, has been the latest addition to the SENAI system. The post-secondary training centres compare favourably to single-purpose faculdades isoladas among Brazilian private universities.

Introduction:

This writer has previously described the Brazilian National Industrial Learning Service, *Serviço Nacional de Aprendizagem Industrial* (SENAI), which began in 1942, as the best national training system in the world, as well as the oldest national training board (Wilson, 1993). During the past decade SENAI has developed a post-secondary sector to complement its training of apprentices at the post-primary level. This post-secondary sector consists of thirteen *Centros Nacionais de Tecnológia* (CENATEC). This article describes assistance from Canadian International Development Agency (CIDA) to develop two of these centres for the training of technicians and technologists.

Centro de Tecnológia Indústrial (CETIND), located in Salvador, Bahia, trains chemical process and instrumentation technologists for petrochemical industries. (*Centro Regional de Tecnológia de Alimentos* (CERTA), the Regional Centre for Food Technology, located in Petrolina, Pernambuco, trains biochemists and quality control technicians for the food processing industries in the states of Pernambuco, Bahia, and other states of Northeastern Brazil.

Post-Secondary Education in Brazil

The formal sector of post-secondary education in Brazil has a longer history than the non-formal non-governmental sector being developed by SENAI. In 1991, The UNESCO Centre for Higher Education in Latin America reported that Brazil had 83 universities, of which 52 were public and 31 private (Cresalc, 1991). In addition, a total of 788 non-university, post-secondary institutions were reported, of which 181 were public and 607 were private. The Brazilian Universities Council of Presidents (CRUB), created in 1996, reports membership of 124 higher education institutions, of which 37 are federal, 36 private, 28 confessional (religious-sponsored) and 23 sponsored by state and municipal government.

Schwartzman (1997) noted that "the most compelling characteristic of higher education in Brazil has been its stasis" (p. 10). He claimed that "Brazilian institutions of higher education have failed to keep pace with the country's growing demand for an educated work force" (p. 10). Since the early 1980s, enrolment has averaged at 1.6 million university students, which has been "less than 10 percent of the available age cohort" and "about two-thirds… are in private institutions" (p. 10).

According to Schwarzman (1992), formal universities were transplanted to Brazil with the Portuguese court in 1808 to escape Napoleon Bonaparte's invasion of Portugal. He reports that the development of federal and state universities, however, only began in the 1930s and 1940s. Large-scale expansion of higher education in Brazil took place during the 1960s. Haar (1997) noted that "postwar modernization necessitated a system of higher learning to meet the manpower requirements of economic growth, and the Brazilian middle-class – a product of this socioeconomic transformation – demanded increased access to higher schooling" (p. 57).

Public universities in Brazil have "traditionally been free of charge, and are fully maintained by the federal or state governments" (Schwartzman, 1992, p. 83). However, in order to gain access to these universities, parents are obliged to send their children to private feepaying secondary schools (Schwartzman, 1992), as well as to cursinhos, or

privately-owned and operated preparatory courses for university entrance examinations (Haar, 1977). This restricts scarce university places to the affluent classes. Private universities charge tuition fees, but these are regulated by government and limited since the majority of students are of lower socio-economic origin. Moreover, private institutions focus on areas of study that do not require expensive equipment and teaching materials and they hire only part-time teachers (Schwartzman, 1992). Many private institutions are faculdades isoladas, or "single-purpose… institutions… not connected with a larger institution" (Haar, 1977, p. 94). Haar decries the "lack of horizontal linkages among higher educational institutions" and notes that their growth "occurred in a haphazard fashion and without an effort towards affiliation or merger" (p. 49).

Schwartzman (1992) maintains that, until the expansionary period of the 1960s and the 1968 reform, Brazilian higher education was influenced by "the traditional Napoleonic notion that higher education institutions were schools licensed by the state to teach and certify for the established professions" (p. 85). He also noted that the system of higher education was "formally unified along two lines: one more traditional, related to the public regulation of the professions; and the other, more modern, oriented towards the organization of knowledge in academic disciplines" (p.85). The co-existence of these two traditions is said to explain the contradictions, contrasts and differentiation evident in both public and private post-secondary higher education in Brazil.

Schwartzman (1992) also comments that "the challenge to Brazilian higher education as it faces the turn of the millennium is whether universities will be able to accommodate the country's growing educational demands" (p. 85). An examination of the new post-secondary institutions being developed by SENAI suggests that a parallel path to post-secondary education may also assist with this needed accommodation.

Background to SENAI

The 1937 Constitution of Brazil stipulated that industrial and economic organizations should establish apprenticeship programs in cooperation with the government. The National Confederation of Industries (*Confederação Nacional da Indústria*) created SENAI in January 1942 to prepare the human resources required for the development of Brazilian industries. SENAI was modelled upon the training system designed by Roberto Mange, a Swiss engineer lecturing at the São Paulo Polytechnic, for the São Paulo State Railways in 1930. It was based upon German and Swiss apprentice-training models. SENAI is organized at the national and state levels as a private, non-profit organization financed by all industrial corporations with a tax of one percent on all payrolls, collected for SENAI by the National Institute of Social Security (INSS).

SENAI initially developed industrial apprenticeship courses for the last four years of ensino de primeiro grau, which is equivalent to primary and middle school. SENAI Centros de Formação Profissional, or SENAI schools, have served 14-18 year-old dropouts from formal schools who might otherwise not have had access to other forms of middle and secondary education. The core of the SENAI instructional method is the *seria metódica occupacionais*, or Shopwork Methodical Series. Prior to the augmentation of this method in 1972, it consisted of (a) *a task sheet*, which describes the operations inherent to a particular industrial task, based upon task analyses (or what the trainee should do, (b) *an operation sheet*, which shows how to perform each operation; and (c) *a technological information sheet*, which describes the equipment and tools essential to the

performance of each operation. After 1974, the training system was supplemented by a *complementary information sheet* explaining the why of each operation or set of operations in order to introduce relevant theory into this practical training system. Trainees followed a structured learning sequence that included (a) studying each task until mastery was demonstrated; (b) development of a work plan for each operation or set of operations; (c) demonstration by the instructor and application by the student to demonstrate mastery; (d) performance of the actual task; and (e) evaluation of trainee performance by the instructor (Wilson, 1991).

The SENAI system continually added components to its training system over the years, including academic education to attain secondary school equivalence, the use of educational technology for demonstrations, development of self-paced, individualized learning modules, and computer assisted-instruction. In addition, SENAI developed other modes of occupational qualification and upgrading/retraining courses to serve employees in industries by means of on-the-job training, developed mobile training capabilities, and even operated secondary technical schools under contract with several state ministries of education, because their superior capabilities were recognized. However, these innovations proved inadequate to face the technological modernization necessitated by industrial change in response to the evolution of a global trading economy, or *globalisation*.

Creation of the SENAI Post-Secondary Sector

The 1994 SENAI Strategic Plan for the Restructuring of Models of SENAI Occupational Training noted the following:

> The introduction of microelectronics in our work processes requires new capacities, including a logical-abstract thinking capacity, which relates to this technical base operating laterally from symbols and from scientific thought. The diffusion of automation will be able to be much higher and requires a system of occupational training for a labour force with a new profile: the capability to solve new problems, ability to work in a cooperative mode, capacity of communication, etc. (SENAI DN, 1995)

The foundation for this fundamental re-direction of the SENAI system dates from the upgrading of the SENAI *Escola Tecnologica da Indústria Química e Têxtil*. This school was built in 1949 to train workers for the textile and apparel industries as a SENAI CFP and became the *Centro Tecnológico de Indústria Química e Têxtil* (CETIQT) in 1979. Courses in textiles, textile chemistry and apparel were differentiated into two levels, a regular course of six semesters for primary school graduates, and new courses at the post-secondary level of four semesters for secondary school graduates. In addition, CETIQT offers qualification courses in fashion design of five semesters for secondary school graduates and a five-year textile engineering course in cooperation with Rio de Janeiro State University. CETIQT also offers short continuing education courses to deliver within industry, to update human resources. The new technological centre model became polyvalent with the addition to the original teaching function of (a) testing and

applied research, (b) technical assistance to industry, and (c) provision of technological information to industry.

The SENAI post-secondary programs became known as Special Technical Courses during the late 1980s and "were designed to meet… growing demand for higher qualified personnel [i.e.] technicians who will be posted in middle management positions" (SENAI DN, 1989, p. 27). These courses comprise "an intensive regime with eight hours of classes daily with a duration of approximately one year at school plus six months of practice at an industry" (p. 27). Intake of students consists of high school graduates 18 years of age or over.

In 1989 there were fourteen Special Technical Courses, of which three were offered as evening courses. The programs included ceramics, electronics, electrotechnical, foundry, graphic arts, instrumentation, mechanics, metallurgy, paper and cellulose, plastics, shoemaking, tanning and textiles. They were offered in the States of Mato Grosso, Rio Grande do Sul, São Paulo and Rio de Janeiro. Graduates were granted certificates as Technicians. By 1991, these programs had been renamed *Centros Tecnológicos* (CETEC) and SENAI began discussions of the technological modernization of its training programs (Ministerio da Educação, 1991). These centres were subsequently renamed CENATECs.

The CIDA-SENAI Project

SENAI received international assistance for the development of curricula, training of instructors, development of research and technical documentation capabilities, and specialized equipment from Germany, France, Italy, Japan, The United Nations Development Program (UNDP) and UNIDO at CENATECs. In 1990, SENAI commenced a project under the Canada-Brazil Cooperation Program oriented towards the improvement of human resource development and institutional strengthening, particularly in the northeast of Brazil. The CIDA Human Resource Development Sector Review, conducted in 1988, identified two important growth sectors in this region of Brazil, the chemical process sector and the food processing sector. The Review also recommended SENAI as the Brazilian partner institution and the CIDE-Ryerson Corporation (CRC) as the Canadian partner institution. CRC was a consortium which brought together Ryerson Polytechnic, now Ryerson Polytechnic University, in Toronto and *Le Consortium Intercollégial de Développement en Éducation* (CIDE), based in Montréal. CIDE is itself a consortium, bringing together universities and *Collèges d'enseignement générale et professionelle* (CEGEPs) in the province of Québec.

Two of the three components of the CIDA-SENAI Project are the topic of this article: CETIND, which was originally called *Centro Tecnológico de Processos Químicos e Instrumentação* (CTPQ) and which received assistance from Ryerson; and CERTA which received assistance from CIDE. The overall project goal was to help improve productivity and output in the private and public sectors, mainly in Northeast Brazil, by contributing to the establishment of these two SENAI CENATEC centres. The purpose of assistance to CETIND and CERTA was to strengthen the institutional capacity of SENAI through support for the establishment of these centres.

CIDA support consisted of the provision of specialized equipment, pilot plant equipment, technical assistance personnel, and training of SENAI instructors in Canada. SENAI contributions consisted of the provision of facilities, some equipment, and support for CIDA technical assistance personnel. The total CIDA contribution for three sub-projects was CD$8 million, phased between 1990 and 1996. CETIND received CD$3.8 million and CERTA received CD$1.8 million.

Both CETIND and CERTA have the CENATEC polyvalent mandate, initially developed at CETIQT, to (a) provide training and upgrading for industrial technicians; (b) provide technical assistance to industry; (c) conduct co-operative research with industry; and (d) disseminate information to small, medium and large enterprises (Wilson & Strachan, 1993). However, both institutions differ from CETIQT and many other CENATECs because they offer training at the post-secondary technician and technologist levels, rather than offering both CENATEC courses and traditional SENAI secondary-level courses.

Centro de Tecnológia Indústrial

CTPQI was initially established in temporary facilities, pending construction of permanent facilities by the SENAI Regional Department in Bahia. Although these facilities were originally planned for completion in February 1992, financial difficulties delayed their completion until 1994. The initial intake of 36 students for the Chemical Process two-year course was drawn from 18 to 20 year-old graduates of general high schools. This initial intake was selected from among 200 sitting the selection examination. The novelty of this course and of the institution resulted in acceptance of students requiring substantial remediation in mathematics and chemistry. However, by 1995 the CETIND reputation – and probably its impressive new facilities – had generated applications from among graduates of the best technical secondary schools in Bahia.

Thirty-three of the initial chemistry course intake graduated in 1995 after completing their *stage*, or industrial practice component, of six months. By August, 23 had secured employment and the remaining 10 were sponsored for an operators course at CETIND by the Companhia Petroqúimico de Camaçari (CPC), the largest of the petrochemical industries. Upon completion of this course, all were guaranteed employment at CPC.

Unfortunately, due to a number of factors, diminished employment opportunities for CETIND graduates in the petrochemical industries resulted in the difficult decision to suspend intake to this course in 1994. Among these factors was the down turn in the Brazilian economy, the privatization of petrochemical companies, the resulting cancellation of the project doubling the Camaçari petrochemical complex, and the ensuing down sizing of the industrial labour force. While the original Human Resource Development study predicted strong demand for laboratory analysis technicians and technologists, changed economic and labour market conditions resulted in low demand for analysts and moderate demand for chemical process operators.

The SENAI-Bahia Regional Department and CETIND substituted in-service training of chemical process and instrumentation technicians, under contractual arrangements with several industries. In addition, courses on environmental controls and waste water management were developed. These courses are designed co-operatively by CETIND and industry. In 1995, CETIND had an intake of 30 for the CPC Operators

Course, 60 for an Operators Course for ALCAN aluminium, and 70 in a pulp and paper course for BASAL. In addition, CETIND established one-and two-week short courses in Digital Process Control, Environmental Management and Introduction to Quality Systems (Wilson, 1995b).

By August 1995, these courses had increased in number to five and several additional courses were under development. The equipment from the former SENAI Instrumentation Training Centre at Camaçari, which was supposed to have been moved in February 1992, was finally moved in April 1995 upon completion of the last CETIND facilities. This enabled the Camaçari Instrumentation instructors to move to CETIND and increased the range of available course offerings. CETIND commenced its first evening course in electronics for employees of Petrobras, the national petroleum company, in August 1995. This ten-month course was designed co-operatively by CETIND and Petrobras. A five-month course for 30 operators was designed for Poliolefinas, another Camaçari petrochemical company. Three small courses on the environment for 30 students each were provided for EMBASA, the public water company for Salvador, in hydrology, water pollution and anaerobic treatment (Wilson, 1995a).

Sixteen CETIND instructors received training at universities and at Colleges of Applied Arts and Technology in Ontario. Unfortunately, four CETIND instructors have left for higher-paying positions in industry. SENAI-BA recently modified its salary policy to retain the investment in trained personnel.

As often happens on aid projects, the last minute addition of one component proved to be one of the most successful outcomes of that project. At CETIND, this component was the Multi-Media Production Unit, which produces state-of-the-art CD-ROM training modules. Each time this writer visited CETIND during the past three years it was observed that this "unit had seemed to have mastered new levels of technological sophistication" on each visit (Wilson, 1995a). Their latest multi-media package on the environment is equal to anything produced anywhere in the world.

The completion of CETIND facilities and commissioning of equipment took place in 1966, with the final installation of the remaining three pilot plants. In 1995, CETIND undertook a strategic planning exercise to customize its polyvalent role. This plan included achievement of financial self-sufficiency within five years through the sale of training, research, information and multi-media services (SENAI-CETIND, 1995). Attaining financial self-sufficiency was compatible with developments, including strategic planning, at National SENAI (SENAI-DN, 1995), since the future of the industrial levy finance system is uncertain (R. R. deSouza, personal communication, August, 1995).

Post-project institutional linkages have been developed with several of the Canadian institutions involved in the CIDA-SENAI project, as well as with Brazilian institutions, research centres, and organizations. In addition, CETIND has been evaluated by CENATEC for certification, together with all SENAI CENATEC centres (SENAI-DN, 1994). The CENATEC bronze medal certification, or *Prémio Nacional da Qualidade* (PNQ), is based upon the U.S. Malcolm Baldridge National Quality Awards and the Demming Prize in Japan (SENAI-DN, 1994).

Centro Regional de Tecnológia de Alimentos

CERTA commenced operations in facilities donated by a federal technical school in Petrolina in 1992 with 12 students, selected from among 50 sitting the selection examination. Four of the initial intake dropped out and the eight remaining completed their internship in industries in 1993; six of the eight graduated. At the time of the mid-term CIDA project evaluation in 1993, four of the eight trainees on stage were already spoken for by employers in the industries where they were placed by CERTA.

The renovation of CERTA facilities encountered difficulties that continue to plague the institution. CIDA technical assistance personnel functioned only in an advisory capacity, since the renovations were financed by SENAI-Pernambuco. However, these personnel did manage to rectify the inadequate ceiling height for the pilot food processing plant before it was built. The industrial model used to design CERTA laboratories, however, could not be changed to an educational model. In addition, problems were encountered with equipment purchased by SENAI from Brazilian suppliers, particularly the pilot food processing plant. However, these equipment anomalies were eventually rectified and CIDA added an automated control function to the pilot plant before the end of the project.

By 1993, four CERTA instructors had completed training at universities and research centres in Québec in microbiology, food technology and instructional methods. Two received training in 1990-91 and two in 1991-92. To date, CIDA has trained ten of the fifteen CERTA staff in Canada. A full-time director was finally appointed in 1994, relieving the part-time founding director, who also directed the SENAI CFP in Petrolina. Two CERTA Instructors who had trained in Canada left for higher paying positions in industry. However, SENAI-PE has also been able to modify its salary policies and this should contribute to the retention of CERTA instructors.

CRC fielded six technical assistance personnel from *l'Institut de Technologie Agro-alimentaire* (ITA) and other institutions in Québec. The initial CERTA courses in microbiology, chemistry and food processing technology were augmented in 1995 by courses on the environment and on new capabilities in dairy, wine, beer and meat processing, necessitated by the introduction of new agricultural products in the region.

In 1993, a second intake of 13 students was admitted, also selected from among 50 sitting the selection examination. One of the 13 dropped out and nine completed their stage in industry. In 1994, the third CERTA intake expanded to 18 students, selected from among 98 sitting the selection examination.

The polyvalent model, pioneered by CETIQT, has also played an important role at CERTA. Although student enrolment was low, the greatest service performed by CERTA has been its technical consulting services to small, medium and large-scale food-processing industries in the region. The development of the research capability at CERTA has been slower to attain, although several successes have been achieved in 1995 in the processing of tomatoes, mangoes and bananas. The technological information component at CERTA has also only recently been implemented.

CERTA is also engaged in the process of PNQ bronze certification, plus developing post-project linkages with institutions in Brazil and Canada in food technology, research and product development.

Conclusions and Comparisons

The development of new institutions – and certainly new types of institutions – is a process fraught with any number of problems, difficulties, stumbling blocks, and setbacks. The success of these two projects is due, in large measure, to the professionalism and dedication of both Canadians and Brazilians. One of this writer's more forceful recommendations to CIDA in the 1993 mid-term evaluation was that CIDA should have appointed a project monitor from the outset of this high technology transfer project, because of the "extremely fragile undertaking requiring continuous monitoring and encouragement of the partners to meet deadlines central to the realisation of project objectives" (Wilson, 1993, p. 25). CIDA's response was to offer this writer the opportunity to serve as project monitor for the remaining two years of the project, an offer that was difficult to refuse.

As noted above, SENAI has consistently added components to its practical training system since its creation in 1942. What impressed this writer the most about SENAI was the integration of all of its system components. That is, curricula were developed by task analyses undertaken in industry, training facilities were planned on the basis of the curricula (which rarely occurs), equipment is also planned on the basis of the curriculum, and supplies and consumable training materials are ordered and delivered on a just-in-time basis in order to teach the curricula. Every aspect of SENAI training is cross-referenced, with the result that SENAI has become a model for replication in other nations. Further, SENAI has developed its own instructor-training capabilities (Wilson, 1991). A culture of constant adoption – and adaptation – has evolved within SENAI.

It is this culture that is currently undergoing painful modernization as SENAI develops its post-secondary sector. The highly centralized, didactic and authoritarian approach that has characterized SENAI since its inception is being changed to conform to the new realities in modernizing workplaces. Instead of training workers capable of dutifully following orders, SENAI is now faced with training *knowledge workers* at the technician and technologist levels who must diagnose and solve production problems, undertake sophisticated laboratory analyses, and use their knowledge for innovation, rather than replication.

The SENAI spirit of innovation and adaptation eventually has prevailed over the hierarchical culture epitomized by the *seria metódica ocupaçonais*. The strategic planning exercises have been accompanied by the reform and decentralization of SENAI administration, and by the development of even more competency-based curricula. As the CIDA Project Director once noted, SENAI is being dragged kicking and screaming into the next century.

As noted above, CETIND and CERTA differ from most other SENAI CENATEC centres because they offer training only at the post-secondary level. This is a completely new departure for SENAI, which originally offered apprenticeship training to primary school graduates and then in the 1980s added a post-secondary component at several centres. This development resembles the creation of technical colleges in Europe and North America from the 1930s onwards. The training of technicians and technologists to accompany technological modernization in industry appears to be a development concomitant with the globalization of trade and industry which has taken place during the past decade.

While the range of courses and the enrolment at these two new centres is small, and it is likely that demand for graduates might soon exceed CERTA capacity, the adoption of the CETIQT polyvalent model of service to industry appears to also be comparable to the development of post-secondary technical colleges in Europe, Japan and North America. The compatibility of this polyvalent approach to practices at Ontario Colleges of Applied Arts and Technology, Ryerson Polytechnic University and Québec CEGEPs suggests that, even if the CETIQT model had not existed, the CRC-CIDA project would have insisted upon the inclusion of this vital project component.

One additional serendipitous benefit of the development of CETIND and CERTA has been the interest raised at universities in both Salvador and Petrolina. Since the formal public universities have been impoverished by decades of rampant inflation and under funding, neighbouring post-secondary institutions have expressed interest in gaining access to the CETIND and CERTA laboratory facilities. This opening for co-operation between formal and non-formal post-secondary institutions can also be compared to current articulation initiatives between Ontario Colleges of Applied Arts and Technology and public universities.

Although this writer thought little of its import at the time, considerable use has been made of one quotation obtained in Israel, during a study of technological education in 1990. The Director-General of the Israel Ministry of Education noted that they were "designing an educational system to fight the economic wars of the next century". It is clear that the metamorphosis of SENAI is also creating a technological education infrastructure to facilitate participation in the evolving global economy.

The opportunity provided by this writer's participation in these projects, initially as a formative evaluator, and then as Project Monitor has enabled the study of technology transfer that SENAI has experienced, as well as its modernization. This writer has recently written that monitoring constitutes a valuable addition to the educational planning process. In addition, insights from the study of the SENAI projects were used in a policy paper on the reform of vocational education and training in Latin America (for Inter-American Dialogue). Specifically, these insights suggest that the latest policy direction in several Latin American nations is the upward differentiation of occupational training to a post-secondary level. SENAI has pioneered this new policy direction and it appears that Chile and other nations are not far behind.

Both Schwartzman (1997) and Haar (1977) have characterized Brazilian formal higher education institutions as 'a peculiar project of modernization from above'. Haar has described the development and planning of post-secondary education in Brazil as having been 'disjointed incrementalism'. These characterizations are expected to become even more complex due to the coexistence of the traditional focus upon professions and the modern focus upon academic disciplines. Apparently, both approaches have influenced modernization from above and the disjointed incrementalism that characterizes the post-secondary planning process.

The planning process adopted by SENAI for the creation of its CENATEC centres appears to differ markedly from this haphazard public post-secondary sector planning and development. Haar (1977) contrasts the long-standing Brazilian commitment to central planning with the fact that these "plans have often been useless and dysfunctional because of low performance capabilities and poor central direction within the government bureaucracy". He characterized the federal Ministry of Education and Culture as "'a

massive, unmanageable bureaucracy'" in which coordination and communication were very poor and productivity was low". In marked contrast, the SENAI national and state capability to translate their central plans into efficient training and educational institutions has been the result of a more viable administrative infrastructure within SENAI than within the public sector.

In another sense, the SENAI CENATEC centres resemble private universities, or *faculdades isoladas*, more than they resemble federal or state public universities, since both CETIND and CERTA are single-purpose institutions. Moreover, the SENAI centres appear to conform to the traditional approach of the regulation of professions and not to the modern approach of academic disciplinary organization.

Finally, it was noted that formal higher education "was traditionally the channel by which a social élite educated and reproduced itself within a highly stratified, regionally unbalanced, and unequally developed society". Although the development of the SENAI post-secondary sector may also be characterized as modernization from above it does appear feasible to conclude that the SENAI history of enabling trainees from lower socioeconomic origins to have access to education and training may redress such inequities.

In view of the unsatisfied demand for access to post-secondary education in Brazil, it appears reasonable to conclude that the entry of SENAI in the provision of post-secondary education will address unmet demand for access to technician and technologist level education and contribute to improvement in the overall quality of Brazilian post-secondary education.

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