

The reformulation of the federal network of professional education as a geopolitical strategy to produce technological innovation in Brazil

Mauro Sergio Pinheiro dos Santos Souza

Instituto Brasileiro de Geografia e Estatística,

Rio de Janeiro, RJ, Brasil

maurospss@gmail.com

 0000-0001-9492-6135

p. 547-562

How to cite this article:

SOUZA, M. S. P. S. The reformulation of the federal network of professional education as a geopolitical strategy to produce technological innovation in Brazil. **Geosp – Espaço e Tempo** (On-line), v. 24, n. 3, p. 547-562, dez. 2020. ISSN 2179-0892.

Available at: <https://www.revistas.usp.br/geosp/article/view/159877>. doi: <https://doi.org/10.11606/issn.2179-0892.geosp.2020.159877>.



Este artigo está licenciado sob a Creative Commons Attribution 4.0 Licence

revista

Geo 
USP
espaço e tempo

Volume 24 • nº 3 (2020)

ISSN 2179-0892

The reformulation of the federal network of professional education as a geopolitical strategy to produce technological innovation in Brazil

Abstract

This article argues that the reformulation of the federal education system was a geopolitical strategy of the Federal Government for professional education and the production of innovations based on territorial potentialities. It addresses the transformations in the professional education of the federal network of education for the improvement of national education and the national and international economic competition. Based on a review of the literature and from the survey of the production of patented innovations, the correlation between professional education and the production of innovations is investigated. The result of the analysis indicates that professional education has improved the production of technical and technological innovations, showing the correlation of this production with the characteristics of the territories where the units of the Federal Institutes are located.

Keywords: Innovation. Professional education. Federal institute.

A reformulação da rede federal de ensino profissional como estratégia geopolítica para produzir inovação tecnológica no Brasil

Resumo

Este artigo propõe uma reflexão sobre a política de reformulação da rede federal de ensino como estratégia geopolítica do governo federal para a educação profissional e as decorrentes imbricações territoriais da produção de inovações. Trata-se do estudo das transformações na educação profissional da rede federal de ensino para a melhora da educação nacional e para a competição econômica nacional e internacional, a partir da prospecção das potencialidades territoriais para a inovação. Com base numa revisão da bibliografia e a partir da pesquisa

da produção de inovações patenteadas, investiga-se a correlação entre a educação profissional e a produção de inovações. O resultado da análise aponta que a educação profissional tem ensejado a produção de inovações técnicas e tecnológicas, evidenciado a correlação dessa produção com as características dos territórios onde ficam as unidades dos Institutos Federais.

Palavras-chave: Inovação. Educação profissional. Instituto federal.

La reformulación de la red federal de educación profesional como estrategia geopolítica para producir innovación tecnológica en Brasil

Resumen

Este artículo sostiene que la reformulación del sistema educativo federal fue una estrategia geopolítica del gobierno federal para la educación profesional y la producción de innovaciones basadas en potencialidades territoriales. Es el estudio de las transformaciones en la educación profesional de la red de educación federal para el mejoramiento de la educación nacional y para la competencia económica nacional e internacional. Apoyado en una revisión de la literatura y de la investigación sobre la producción de innovaciones patentadas, se busca la correlación entre la educación profesional y la producción de innovaciones. El resultado del análisis indica que la educación profesional ha mejorado la producción de innovaciones técnicas y tecnológicas, ya que esta producción tiene características territoriales de dónde se ubican las unidades de los Institutos Federales.

Palabras clave: Innovación. Educación profesional. Instituto federal.

Introduction

In the 2000s, after the government of President Luiz Inácio Lula da Silva, the federal government undertook a reformulation in the professional education of the federal network of education aiming to give a new meaning to this educational modality in the country. The reformulation of professional education is a corollary of the changes made in the national productive system, in which it was sought to reframe this education congruent with the requirements of this century. This change was linked to the creation of a new institutional image in 2008, an emblematic symbol of the changes that were aspired for the federal network of professional education: the Federal Institutes of Education, Science, and Technology.

With this new institutional paradigm, professional education was guided towards the production of technical and technological innovations, while aiming to encourage the subnational scales in the national and international economic competition. Underlying this federal government strategy is the motto of engaging different parts of the country in economic competition, in a clear geopolitical claim to reduce Brazilian dependence on technology from developed countries (Ibañez, 2014, p. 132).

Nevertheless, the discussion about the production of science and technology (S&T) also involves the territory where it is produced. To this extent, the Federal Institutes and the other federal institutions of professional education are a contemporary example of using the potential of the territory for the production of innovations. At the same time, innovation and the “culture of innovation” do not occur linearly, and imply a series of legal and institutional actions and articulations that present themselves as challenges for the new institutions (Ibañez, 2014).

It is important to note that the construction of a National Innovation System depends on educational institutions as key players in its expansion and strengthening. Thus, the federal institutions of professional education play an important role in the national scenario of S&T production, mainly because they are institutions with well-known capillarity in the Brazilian territory since the expansion of the federal network of professional education.

Taking these considerations into account, this paper argues that the reformulation of the federal network of professional education aimed, on the one hand, to expand the Brazilian educational formation, with the territorial expansion of the network to different parts in the country, and, on the other, to explore the potentiality of different places to produce technological innovations as a Brazilian geopolitical strategy, based on the correlation between professional education and the S&T production. Thus, it would be a matter of guiding public management to support and induce technological innovation processes based on science and research (Campolina; Diniz, 2014). Finally, I will present examples of how the Federal Institutes have produced innovations that reflect the prospect of local potential.

The paper is divided into two sections, in addition to the introduction and final considerations: in the first, I present an overview of professional education and the federal network; in the second, I point out the relationship between professional and technological education and S&T production and incorporate examples of this production by Federal Institutes in different socio-spatial contexts of Brazil.

Overview of the federal network of professional education

The problems of the Brazilian educational base persist in this century. They are not only linked to access, since there have been advances in the provision of basic education, but they include the quality of the offered public education. More than that, the difficulties of the structure of the national education system persist, with significant disparities between the different education networks (Frigotto; Ciavatta, 2003; Kuenzer, 2000; Manfredi, 2002).

In this context, in the 2000s, mostly, the federal network of education underwent an expressive reformulation, after the systematic expansion of the network from 2005. The changes ranged from the conception of the curriculum of professionals with secondary education to the

very purpose of the professional education, tied to the expansion of the network implemented by the creation of new units in different regions and municipalities in the country. To produce innovations and technology based on the exploration of the potential of the territory at different subnational scales, the importance of professional education has been revalued and re-qualified,

Thus, it can be stated that the design of Federal Institutes, with Law No. 11,892, of December 29, 2008, appears in a context in which the federal government redirects the role played by the federal network of professional education. For this educational modality, it was proposed a way to answer the demands and challenges of the capitalist economic dynamics and contemporary Brazilian society. Thus, the creation of the Federal Institutes emerges as a strategic driver of the federal government's public education policy that aims, at the local and regional scales, to induce the production of technical, technological, and social technology innovations; train professionals to serve the labor market; increase the educational level of the served population; and generate solutions based on the demands that appear on these scales.

It should be noted, also, that the creation of the new institutionalization of the federal network of professional education covered, at least, all state mesoregions and the Federal District. In other words, it was a project in the educational field led by the Federal Government with national coverage, which reverberated and had an impact in the different regions of the country where federal professional education units were installed. New goals were set for professional education, which had been transformed into an asset for local and regional development and the country as a whole. Thus, professional education was oriented towards the promotion of technical and technological innovations, based on the potential and local and regional specializations. Also, federal institutions of education would collaborate in solving local and regional demands.

There are many denominations for professional education: vocational education, vocational or technical training, industrial or technical-industrial education, qualification, requalification, and training. These designations are historically forged to translate the productive environment and the reorganization of the labor processes on which they are based:

[...] there are from those who consider Professional Education in a compensatory and assistentialist perspective, as a form of education for the poor, to those centered on technical-instrumental rationality, who advocate a training aimed at satisfying the changes and innovations of the productive system and the dictates of the current economic model of Brazilian development, as well as those who are guided by the idea of technological education, from the perspective of training workers as collective and historical subjects. This orientation defends the link between technical training and a solid scientific basis, from a social and historical-critical perspective, integrating preparation for work with secondary education. Along the same lines, some conceptions understand training for work as one of the educational dimensions of the human formation process. Professional Education, as a social right, is thus a dimension that must be incorporated into schooling projects of elementary and high school level aimed at young people and adults belonging to popular groups (Manfredi, 2002, p. 57).

Professional education expands students' perspectives, becoming fundamental to development. However, even though education provides greater employability, allowing for new opportunities, it is necessary to remember that education, by itself, is not capable of generating income and work, since it depends on the productive structure to create these possibilities (Grabowski, 2006, p. 115).

Manfredi (2002, p. 107) argues that the changes that have taken place in the production system, with the flexible accumulation of capital, caused tensions between the past model of professional education and the new demands of the labor world. Thus, it is relevant to point out that with the changes in the productive system, a questioning of the country's educational base emerges and, to that extent, professional education would also have to respond to the changes that occurred in the capitalist structure (Ferretti, 1997).

The debates that emerged on the role of professional education of the population, since the 1990s, among civil society, which included educators and other organized sectors; the proposals coming from the Ministries of Education and Labor; and the perspective that originated in the business sector (Manfredi, 2002) reflects the relevance that the theme has reached when thinking about the educational future of the country.

Within the government, in the 1990s, there were two proposals for professional education: one from the Ministry of Labor and another from the Ministry of Education. The first favored training that qualified or retrained the worker, preferably young people and adults, and allowed continued education that was not limited to "training". Hence, professional education should include "the development of basic, specific, and management skills and knowledge, aimed at the plural development of the individual" (Manfredi, 2002, p. 116).

At the same time, it would endorse the knowledge derived from the individual's work experience and guarantee their admission to the formal education system. As a public policy, it would aim to compose a national plan for economic and technological development supported and linked to other employment, labor, and income policies. Furthermore, the policy should be guided by the decentralization of services, combined with resources of public, private, and external origin, and in the articulated guidance of unions, non-governmental organizations (NGOs), and existing structures, such as the public network and the S system. The proposal also included the creation of education agencies whose objective was to offer training, at the same time that they would be configured as "institutional centers, responsible for courses, services, and advisory services to the community" (Fidalgo, 1999¹ apud Manfredi, 2002, p. 117).

The Ministry of Education's proposal aimed at creating a National Technological Education System. Such a proposition had developed countries as a reference, since, for Brazil to reach a new level of development, it would be necessary to invest in the training and development of human resources. This system would offer courses at various levels, from courses for those who did not have the opportunity to attend school to those with higher education, which would include the training of technicians and technologists and, within the university, professionals trained in scientific research (Kuenzer, 1997² apud Manfredi, 2002, p. 118).

1 FIDALGO, F. *A formação profissional negociada: França e Brasil, anos 90*. São Paulo: Anita Garibaldi, 1999.

2 KUENZER, A. Z. *Ensino médio e profissional: as políticas do Estado neoliberal*. São Paulo: Cortez, 1997. (Questões de nossa época, 63.)

Within the civil society, the project of educators and other organized sectors proposed the creation of a unitary basic school, in which a general and broad formation of the young population was sought, under the idea of critical thinking training and for participation in a social and productive life. It was understood that the unitary school would train people able to understand the general scientific principles that guide the production process, to build basic instrumental skills, and to critically understand the historical formation of society and the ways of acting of man as a citizen, subject and object of history (Kuenzer, 1997³ apud Manfredi, 2002, p. 120). Professional training would follow this basic training and seek to develop skills for the student to work technically and intellectually.

The business sector, for its part, strongly advocated the necessary improvement in the quality of basic education, while advocating for the S system in professional training. Likewise, the sector intended to see its interests represented in the conduct of professional training, by claiming participation in the teaching councils of technical schools and professional education in general. It also reinforced the need to combine technological courses with the productive sector and desired greater integration between Senai's technological centers and universities.

Thus, they intended to speed up the process of diffusion of new technologies, such as the training and refreshing of workers through the articulation between Senai and universities. Concerning professional training, entrepreneurs claimed participation in the preparation, implementation, and management of public policies. Finally, its claims approached the MEC proposal, with the safeguarding of the autonomy of the management of S System.

The interest in recognizing the importance of these discussions is based on the premise that the various proposals coming from the social segments and the State, although they have not been fully adopted in the Law of Directives and Bases of Education (LDB) (Law No. 9,394/1996) served to influence the choices embodied in the law. This happened not only because of the difficulties inherent in attending to interests that alternately converged or diverged but also because of the very political-ideological orientations that guided the government of President Fernando Henrique Cardoso. In this sense, in line with the guidelines of the World Bank on the issue of education in countries in crisis in Latin America, the Brazilian State should provide education to the population at the lowest possible cost (Kuenzer, 2000).

The reform led by Fernando Henrique Cardoso's government concerning secondary and professional education was intended to respond to the new economic and social demands of the globalized society, brought about by new standards of productivity and competitiveness. Thus, national education should assume standards that matched the new economic context of productive flexibility, expanding access to basic education, along the same path taken by developed countries.

The field of professional education would have a complementary character, in which the aptitudes for productive life would be developed, designating this training for graduates of elementary, secondary, and higher education, as well as for the worker in general, regardless of education. Regulating the LDB, Federal Decree No. 2,208/1997 established

3 KUENZER, A. Z. *Ensino médio e profissional: as políticas do Estado neoliberal*. São Paulo: Cortez, 1997. (Questões de nossa época, 63.)

that professional education would aim to: train secondary level technicians and higher-level technologists for the various sectors of the economy; confer specialization and improvement of workers' technological knowledge; and qualify or requalify young people and adults with any level of education for work.

Criticisms of the reform implemented with the new LDB exposed the dual character given to basic education, by separating professional education and high school education into two different systems. Another criticism of the law argues that this differentiation reinforced the Taylorist model of perception of education, by distinguishing the academic education, less valued for not being practical, and the technological education, which does not recognize the transdisciplinary character of contemporary science (Kuenzer; Ferreti, 1999⁴ apud Manfredi, 2002, p. 134). The costs required by the training in professional education must also be considered, as they are much higher than those demanded by regular high school.

According to Manfredi (2002, p. 135), both structures compromised the democratization of access to secondary education for many sectors of the popular classes. Besides, the network of regular high school would allow the continuation of studies in university education, while the network of professional education would be based on market logic. The author points out that the generalist education of the regular high school would act as a brake on the formal labor market, as it would act as a compensatory mechanism and social tension regulator. Jobs that require more qualification would be restricted to a small portion of the population.

Article 44 of Provisional Measure No. 1,549-28, of March 14, 1997, restricted the role of the federal government in offering technical education. The Federal Government exempted itself from the task of expanding the federal network of technical education by the creation of new teaching units subordinate to it. In this context, it relegated this role to states, municipalities, the Federal District, NGOs, and the productive sector, which would be responsible for the maintenance and management of the new educational establishments. This measure, along with other legal and institutional changes, profoundly marked the agony perceived by the federal technical schools, even leading to a decrease in budgetary and human resources.

In an overview of the high-school-level technical education in the late 1990s, Manfredi (2002, p. 160) points out that there was no uniformity in the public school system, in the three levels of government. The author reveals that the transformation that was underway at the time intended to improve the professional education system, perceived by the approximation of technical schools to productive sectors, in which it met the market logic and the financial autonomy of these schools. The author points out that, in reality, autonomy expressed the non-dependence on resources coming from the Federal Government.

Within this framework, in 2002, the federal institutions of education constituted a network of secondary and post-secondary schools, formed by the Federal Agrotechnical Schools, Federal Technical Schools, and the Federal Centers for Technological Education (Cefet). At the time, there were 19 educational institutions spread across the country, mostly in capitals. These schools had a prominent role in Brazilian high school, despite representing only 14.1% of the total enrollment of professional courses at secondary, post-secondary, and supplementary

4 KUENZER, A. Z.; FERRETI, C. Políticas públicas referentes à formação profissional no Brasil. 1997. Mimeo.

levels. When referring to federal technical schools in the 1980s and their participation in the context of technical education, Frigotto, Ciavatta and Ramos (2005a, p. 36-37) understand that:

Regarding federal technical schools, in contrast, the inflection promoted by Law no. 7,044/82 began to value again the training they developed, since they would be the most appropriate institutions to confer the professional character to the secondary level, focused on training in specific professional qualifications. We can state that, from this law, until the end of the 1980s, federal technical schools performed their function of training high-quality technicians, with the acknowledgment of state bureaucracies and civil society, which exempted them from any questioning about their economic and social role.

Manfredi (2002, p. 162) points out that the creation of the National Technological Education System, in 1994, foresaw the transformation of federal technical schools in Cefet, which did not prosper, with the advent of Decree no. 2,406/1997. The author quotes and agrees with Cunha (2000, p. 262)⁵ in saying that a policy of the Federal Government's lack of responsibility for the provision of technical education in the federal education system was implemented. A series of structural changes that separated academic education from technical and professional education at the pedagogical and institutional level were established. Thus, the existing federal institutions would dedicate themselves exclusively to technical education. With these changes, technical schools have expanded their activities, replacing long-term technical courses of secondary level (3 to 4 years) with post-secondary technical courses.

Federal institutions should also provide services to companies and government agencies, generating new budgetary sources. The federal schools would assume, then, a profile of "great supermarket of professional courses, of levels and duration as diverse as possible" (Manfredi, 2002, p. 164), a process designated by Cunha (2000)⁶ as "*senaiização*"⁷ of technical schools federal.

The changes in the political orientation of the Federal Government since the Lula government are largely due to the extensive debate outlined in the country since the 1990s on secondary and professional education. The reforms carried out by the Federal Government reinforced a notable concern with the quality of national education and the role of secondary and professional education in the education system. Thereby, it was advocated the idea that education should have a scientific basis, which would enable a broader education for the individual, not being restricted to the needs of the economy (Brasil, 2004).

In the political changes since 2003, there were some notable improvements in terms of professional education. Frigotto, Ciavatta and Ramos (2005b, p. 2) claim that the Ministry of

5 CUNHA, L. A. *O ensino profissional na irradiação do industrialismo*. São Paulo/Brasília: Ed. Unesp/Flacso, 2000.

6 CUNHA, L. A. *O ensino profissional na irradiação do industrialismo*. São Paulo/Brasília: Ed. Unesp/Flacso, 2000.

7 TN: the word is a neologism that combines the stem "*SENAI*" and the suffix "*ização*". The former stands for *Serviço Nacional de Aprendizagem Industrial* (Portuguese for National Service for Industrial Training), a network of professional schools that provides formal training for specialized workers for the industry. The later refers to the result of an action or process. The combination of both suggests a process in which something acquires the same functions and features of this type of school.

Education, starting with the Lula government, sought to reconstruct professional education as public policy and

[...] correct distortions of concepts and practices resulting from policies adopted by the previous government, which explicitly dissociated professional education from basic education, shortened technical training in dissociated and rigid modules, granting a superficial aspect to the professional and technological training of young people and adults workers.

For Kuenzer and Grabowski (2006), the professional education policy must be a State policy, based on the assumption that the strategic role played by education and the production of scientific-technological and socio-historical knowledge is recognized. As a State policy, “changes in the educational system must be guided by long-term objectives and a clear conception of the mission of higher education, its challenges and commitments to the Nation” (Andifes, 2004, p. 14), to overcome the commercial perspective as a strategy to overcome social inequalities.

Thus, the professional education offered by federal institutions should focus on the need to promote the development of scientific and technological production, by integrating propaedeutic and technical education. The increase in the scientificization of social life, as a productive force, demands from the worker the appropriation of scientific, technological, and socio-historical knowledge. Science and work once again become the same unit through the mediation of technology, by establishing new forms of relationship between knowledge, production, and social relations, which requires an integrated domain of scientific, technological, and socio-historical knowledge.

Professional education and S&T production as a geopolitical strategy

The correlation between education and scientific and technological production, as a strategic mechanism to capitalize on the local potential for technological production, runs through the very conception of the link between Science, Technology, and Society. Mentioning Dagnino (2001)⁸, Kuenzer and Grabowski (2006, p. 304) present two ways of dealing with the relationship between science, technology, and society: the first approach understands that S&T supposes a continuous and inexorable advance, following its path, being independent of social relations, which may or may not influence society in any way; the other is aimed at society, recognizing that the character of S&T, and not just its use, is socially determined.

The fabric of conceptions, policies, and forms of organization of professional education refers to how this relationship is conceived. On the one hand, the reductionist approach gives professional education a dimension of either neutrality or determinism based on the understanding that science is the source of true and universal knowledge. It is not recognized in this school of thought the political face of scientific and technological development. It starts from the premise that neutrality is a condition, in the sense that S&T is not related to the socio-cultural context

8 DAGNINO, Renato. Enfoques sobre a relação ciência, tecnologia e sociedade: neutralidade e determinismo. *Sala de Lectura CTS+I*. 2001. Disponível em: <https://www.oei.es/historico/salactsi/rdagnino3.htm>. Accessed on: 31 jul. 2020.

in which it is generated and, thus, the production of science would require the isolation of the social context as a condition.

Kuenzer and Grabowski (2006, p. 20) criticize the conception that producing science in isolation from the social context is possible, as it would lead to the conclusion that alternative S&T developments would be impossible since there would be only one scientific truth. Thus, economic, social, cultural, and geographical differences would be left in the background, subsumed by the “scientific truth” and requiring to be subject to adaptations.

Thus the contradictions would be resolved naturally, through paths illuminated by science itself, with new knowledge and techniques that would rationally surpass the old ones, without calling into question the acts and interests of social actors in the innovative process (Dagnino, 2001⁹ apud Kuenzer; Grabowski, 2006, p. 20).

Therefore, this neutralizing conception of S&T would present progress as a succession of phases over a linear and homogeneous time, which would lead to improved results in a successive, continuous, and cumulative manner. The development of S&T would be, in terms of knowledge, the manifestation of reality as it is perceived by the scientist, and it is up to him to unveil the truth progressively. It induces a universal S&T perspective, by assuming that knowledge created and used by different civilizations could be appropriate for any purpose and by different social actors at any time and place.

According to Cassiolato and Lastres (2005, 2007), until the 1960s, innovation was seen as a linear process, referring to stages that would follow from basic research, going through applied research, development, production, and diffusion. In the 70s and 80s, a new theory of innovation is conceived, based on the experiences developed by the University of Sussex (England) and Yale (USA). This interpretation advocated the relevance of the design of formal and informal networks, meeting the needs of users, the accumulation of internal training as an essential factor for the interaction of companies with external sources of information and knowledge, and the appropriation, by companies, of knowledge generated within the national economy as part of the innovation process.

On the other hand, Brazil has increased its production of technological innovations, despite the predominance of this production that persists in central countries (Campolina; Diniz, 2014). The increase in this production at the national level is the result of a series of legal, institutional, and political changes that can be seen in the country mainly from the 2000s (Ibañez, 2014).

Nevertheless, the increase in the production of innovation is not unpretentious and shows the intensification of global economic competition, assuming an undeniable contemporary geopolitical character. In this sense, the role of geopolitics must be rethought, as there is a “new meaning of geopolitics, which no longer acts in the conquest of territories, but in the appropriation of the decision on its use” (Becker, 2004, p. 20-21).

The systematic expansion of the federal network of education, starting in 2005, and the concept of the Federal Institutes, in 2008, are part of the perspective of using the territory as

9 DAGNINO, Renato. Enfoques sobre a relação ciência, tecnologia e sociedade: neutralidade e determinismo. *Sala de Lectura CTS+I*. 2001. Disponível em: <https://www.oei.es/historico/salactsi/rdagnino3.htm>. Accessed on: 31 jul. 2020.

a geopolitical strategy for the federal government, especially for the production of innovation based on the prospection of territorial potential in the country. This is evident, for example, in the law creating these institutions, as it is established that, as part of their institutional mission, they must: develop professional and technological education as an educational and investigative process for generating and adapting technical and technological solutions to social demands and regional peculiarities; carry out and stimulate applied research, cultural production, entrepreneurship, cooperativism, and scientific and technological development; and promote the production, development, and transfer of social technologies, notably those aimed at preserving the environment.

According to Machado (1993), contemporary geopolitical analyzes must consider technological innovation, as it has political and social consequences that revolutionize social and productive life. Furthermore, “technological innovation shows nothing more than the potential for using the territory closer to the true needs of a country, as well as strengthening its bases of power” (Ibañez, 2012, p. 88). Nevertheless, the author points out that technological development does not homogenize spaces, but rather deepens their inequalities.

As a result, S&T does not separate itself from the socio-spatial reality where it is produced, even though this production may be appropriated in different places in different ways. This concern is important because, by offering different professional and academic courses, federal institutions of professional education can produce S&T by prospecting local and regional potential. These institutions appear to be responsible for the production of S&T, by capitalizing on the training courses, the cultural particularities of the social actors, and the economic characteristics of the territory in which they operate, at the local and regional scales, as key factors for the development of technical and technological innovations.

This is the emphasis given by the federal government to professional education within the federal network of education, especially with the creation of the Federal Institutes of Education. The speech of the secretary of professional and technological education of the Ministry of Education, Eliezer Pacheco (2011, p. 15), translates this idea.

In the proposal of the Federal Institutes, to add academic preparation to work preparation (understanding it in its historical sense, but without failing to establish its ontological sense) and to discuss the principles of the technologies related to it, shed light on essential elements for the definition of a specific purpose for the curricular structure of professional and technological education. What is proposed is a contextualized formation, bathed in knowledge, principles, and values that enhance human action in the search for more dignified ways of life. Thus, breaking down the barriers between technical and scientific education, articulating work, science, and culture from the perspective of human emancipation, is one of the basic objectives of the Institutes. Its pedagogical orientation must refuse exclusively encyclopedic knowledge, relying on analytical thinking, seeking a more comprehensive and flexible professional training, with less emphasis on training for jobs and more on understanding the world of work and qualitatively superior participation in it; a broader professionalization that opens up infinite possibilities

of reinventing itself in the world and for the world, principles that are valid even for engineering and degrees.

Thus, it is understood that the reformulation of professional education is part of a broader context, in which the capacity to strengthen the production of innovations in the country as a strategy to reduce the national dependence on foreign technologies is at stake. The systematic expansion of the network was a way in which the federal government aimed to cover the entire national territory, covering the different regions of the country. With this expansion, a transformation of the network was undertaken to give new meaning to professional education which, in addition to training critical citizens and elevating Brazilian education, should focus on technological innovation, with the principle of using the potential of the territory, in the most diverse Brazilian socio-spatial realities.

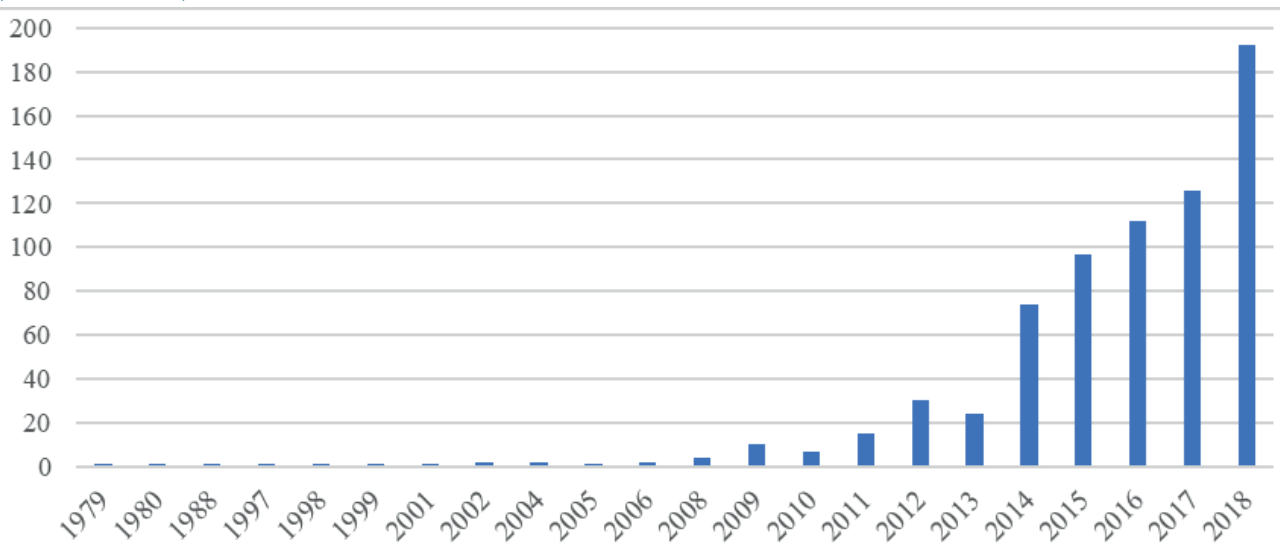
Thus, it's worth mentioning some examples of innovations carried out by the networks from local potentialities, specifically considering the registration of patents, as extracted from the page of the National Institute of Industrial Property (Inpi). In the North of Brazil, the Federal Institute of Amazonas has filed a patent for the preparation and conservation process of tucupi for human consumption. Tucupi is a typical delicacy from the North and is part of regional cuisine. The invention makes use of a local potentiality for improvement in production, introducing in the market a patent that arises from certain local and regional characteristics.

In the Northeast Region, the Federal Institute of Bahia has registered a patent for manual cocoa-breaking equipment, as it is simpler and manual equipment for breaking cocoa that allows its use by only one person, instead of two, as usual. Furthermore, Bahia is responsible for a large part of the national cocoa production, which implies that the invention can lead to improvements in the local and regional economy.

On the other hand, we emphasize that the expansion of the production of innovations depends on multiple institutional factors. For instance, there is a need for budgetary resources to carry out scientific research, trained and engaged teachers for the production of innovations and technologies, and institutional infrastructure capable of serving the community for this production, besides a clear institutional policy that gives the necessary support to the enterprise innovative, among other factors.

In addition to these examples, there is clear evidence that the changes undertaken by the federal government were effective. Considering the federal network of professional education (Federal Institutes and Cefet), in the period available for consultation on the INPI website, there is a systematic increase in the registration of patents by these institutions across the country (Graph 1).

Graph 1 - Deposit of patents by the federal education system in Brazil (1979-2018)



source: Elaborated by the author with data from Inpi ([s.d.]).

Thus, the expansion of the production of innovations by the federal network of professional education is notorious. Despite the change made in the federal network, with the creation of the Federal Institutes in 2008, it is only from 2014 that a systematic increase in the records of these innovations is noticed. Therefore, the process of producing innovations requires institutional maturity related to cultural, legal, and institutional changes by the new institutions that make up the network, to achieve the purpose that the creation of the new institutionality aspired to (Souza, 2016).

Final considerations

The objective of the article was to demonstrate that the reformulation of the federal network of education based on the relationship between professional and technological education and the production of innovation was a geopolitical strategy of the federal government. To this end, the new institutionality of the federal network of education, the Federal Institute, aimed to respond to the demands of changes in the contemporary productive system. Furthermore, the federal institutions of professional education are also a link between education, science, and society for technological production, with the particularity of exploring the potential of the territories to innovate.

Also, the institutes and other federal institutions of professional education integrate the construction of a National Innovation System, noting that the consolidation of the system depends on several factors (macroeconomic, social, institutional, political, legal, and financial factors). Because of this, we can consider that the Federal Institutes are part of a broader context in which it seeks to defend national content for technological development (Ibañez, 2012, p. 91).

Consequently, the institutional framework that favors scientific knowledge and innovation as practices of the national economy is subject to the construction of a solid and coherent system of which educational institutions are an essential part. On the other hand, the State must

have in perspective that the innovation capacity of the different territories is, in part, tied to the uneven historical development in the different regions of the country.

Furthermore, it is necessary to include in the debate on the expansion of the production of innovations the perception of the territory as a fundamental base, where they are generated, and the possibility of its further incorporation by the local, regional or global economy. Also, it is imperative to discuss the appropriation of these innovations and the social objectives they are intended for (Campolina; Diniz, 2014). Nevertheless, the Federal Institutes and the other federal institutions of professional education are institutions capable of giving new possibilities to the places they serve, especially with the purpose of innovating.

References

- ANDIFES. ASSOCIAÇÃO NACIONAL DOS DIRIGENTES DAS INSTITUIÇÕES FEDERAIS DE ENSINO SUPERIOR. **Reforma Universitária:** proposta da Andifes para a reestruturação da educação superior no Brasil. Brasília, DF: Andifes, 2004. Disponível em: http://www.andifes.org.br/wp-content/files_flutter/1364828028PropostaAndifes.pdf. Acesso em: 27 jul. 2020.
- BECKER, B. K. **Amazônia:** geopolítica na virada do III milênio. Rio de Janeiro: Garamond, 2004.
- BRASIL. Ministério da Educação. Secretaria de Educação Profissional e Tecnológica. **Concepções e diretrizes da educação profissional e tecnológica:** política da EPT 2003-2010. Brasília, DF: MEC, 2009. Disponível em: http://www.inmetro.gov.br/painelsetorial/palestras/Luiz_Augusto_Caldas_Pereira_Concepcoes_Diretrizes.PDF. Acesso em: 2 jul. 2019.
- BRASIL. Ministério da Educação. **Subsídios para o processo de discussão da proposta de anteprojeto de Lei da Educação Profissional e Tecnológica.** Brasília, DF: Setec. 2004. Disponível em: http://portal.mec.gov.br/setec/arquivos/pdf/subs_02fev05.pdf. Acesso em: 9 jun. 2019.
- CAMPOLINA, B.; DINIZ, C. C. Crise global, mudanças geopolíticas e inserção do Brasil. **Revista de Economia Política**, v. 34, n. 4, p. 638-655, 2014. doi: <https://doi.org/10.1590/S0101-31572014000400008>.
- CASSIOLATO, J. E.; LASTRES, H. M. M. Inovação e sistemas de inovação: relevância para a saúde. **RECIIS – Revista Eletrônica de Comunicação, Informação & Inovação em Saúde**, Rio de Janeiro, v. 1, n. 1, p. 153-162, 2007. doi: <https://doi.org/10.29397/reciis.v1i1.890>.
- CASSIOLATO, J. E.; LASTRES, H. M. M. Sistemas de inovação e desenvolvimento: as implicações de política. **São Paulo em Perspectiva**, São Paulo, v. 19, n. 1, p. 34-45, 2005. doi: <http://dx.doi.org/10.1590/S0102-88392005000100003>.

- FERRETTI, C. J. Formação profissional e reforma do ensino técnico no Brasil: anos 90. **Educação & Sociedade**, Campinas, v. 18, n. 59, p. 225-269, 1997. doi: <https://doi.org/10.1590/S0101-73301997000200002>.
- FRIGOTTO, G.; CIAVATTA, M. Educação básica no Brasil na década de 1990: subordinação ativa e consentida à lógica do mercado. **Educação & Sociedade**, Campinas, v. 24, n. 82, p. 93-130, 2003. Disponível em: <http://www.scielo.br/pdf/es/v24n82/a05v24n82.pdf>. Acesso em: 11 jul. 2019.
- FRIGOTTO, G.; CIAVATTA, M.; RAMOS, M. A gênese do Decreto n. 5.154/2004: um debate no contexto controverso da democracia restrita. **Trabalho Necessário**, v. 3, n. 3, p. 1-26, 2005a. Disponível em: <http://forumeja.org.br/pf/sites/forumeja.org.br/pf/files/CIAVATTAFRIGOTTORAMOS.pdf>. Acesso em: 11 jul. 2019.
- FRIGOTTO, G.; CIAVATTA, M.; RAMOS, M. A política de educação profissional no governo Lula: um percurso histórico controvertido. **Educação & Sociedade**, Campinas, v. 26, n. 92, p. 1087-1113, especial, out. 2005b. doi: <http://dx.doi.org/10.1590/S0101-73302005000300017>.
- GRABOWSKI, G. Ensino médio integrado à educação profissional. **Boletim**, Brasília, DF: MEC, n. 7, p. 5-15, 2006. Disponível em: http://portal.mec.gov.br/setec/arquivos/pdf2/boletim_salto07.pdf. Acesso em: 8 jun. 2019.
- IBAÑEZ, P. Geografia e Inovação: uma abordagem urgente. **Espaço Aberto**, Rio de Janeiro: UFRJ, v. 4, n. 1, p. 121-138, 2014. Disponível em: <https://revistas.ufrj.br/index.php/EspacoAberto/article/view/2437/2082>. Acesso em: 11 jul. 2019.
- IBAÑEZ, P. **Geopolítica e inovação tecnológica**: uma análise da subvenção econômica e das políticas de inovação para a saúde. Tese (Doutorado em Geografia) – Faculdade de Filosofia, Letras e Ciências Humanas, Universidade São Paulo, São Paulo, 2012. Disponível em: <http://www.teses.usp.br/teses/disponiveis/8/8136/tde-05072012-143758/pt-br.php>. Acesso em: 11 jul. 2019.
- INPI. INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL. Instituto Nacional da Propriedade Industrial. Disponível em: <https://gru.inpi.gov.br/pePI/jsp/patentes/PatenteSearchBasico.jsp>. Acesso em: 8 jun. 2019.
- KUENZER, A. Z. O ensino médio agora é para a vida: entre o pretendido, o dito e o feito. **Educação & Sociedade**, Campinas, v. 21, n. 70, p. 15-39, 2000. doi: <https://doi.org/10.1590/S0101-73302000000100003>.
- KUENZER, A. Z.; GRABOWSKI, G. Educação profissional: desafios para a construção de um projeto para os que vivem do trabalho. **Perspectiva**, Florianópolis, v. 24, n. 1, p. 297-318, 2006. Disponível em: <https://periodicos.ufsc.br/index.php/perspectiva/article%20/download/10762/10269>. Acesso em: 11 jul. 2019.

- MACHADO, L. O. Sociedade urbana, inovação tecnológica e a nova geopolítica. **Revista Brasileira de Geografia**, Rio de Janeiro: IBGE, v. 55, n. 1/4, p. 5-13, 1993. Disponível em: https://biblioteca.ibge.gov.br/visualizacao/periodicos/115/rbg_1993_v55_n1_n4.pdf. Acesso em: 11 jul. 2019.
- MANFREDI, S. M. **Educação profissional no Brasil**. São Paulo: Cortez, 2002.
- PACHECO, Eliezer. Os institutos federais: uma revolução na educação profissional e tecnológica. In: PACHECO, E. (Org.). **Os institutos federais: uma revolução na educação profissional e tecnológica**. São Paulo: Moderna, 2011. p. 13-32.
- SOUZA, M. S. P. S. **Os institutos federais de educação, ciência e tecnologia como vetores de desenvolvimento territorial no estado do Rio de Janeiro**. Dissertação (Mestrado em Geografia) – Universidade Federal Fluminense, Niterói, 2016.