

Chapter 5

Capacity building and services for the Brazilian food and agriculture system

This chapter outlines the role of infrastructure capacity, skills and education in facilitating innovation in agri-food. It describes the governance of policies to improve rural infrastructure, outlines the main regional programmes, and reviews briefly the quality and coverage of rural services. It then discusses efforts to respond to skill demands from the agri-food sector through labour, immigration and education policies. It also reports on trends in education expenditure and outlines the performance of the education system. Finally, it provides an overview of education levels in agricultural, and enrolment in agricultural programmes, outlining the gap between supply and demand of skills in the sector.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

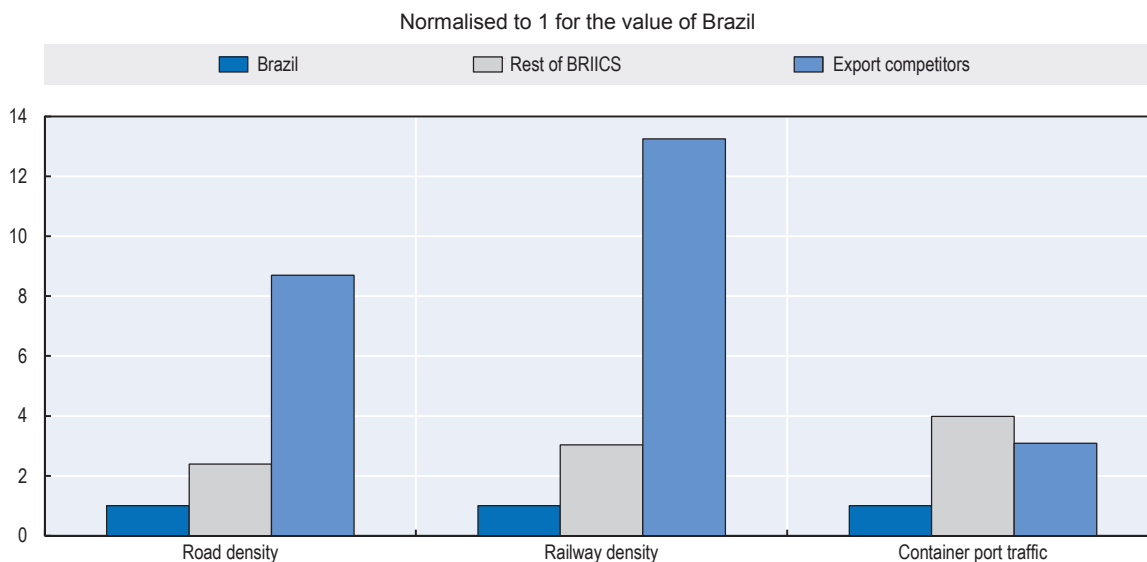
Infrastructure and rural development policies¹

Infrastructure is a linking element of the economic system that enables the movement of factors of production, goods, and information across agents and markets. As such, infrastructure is important in determining the location of an economic activity and the kinds of activities or sectors that can develop within the economy. The availability and quality of infrastructure affect the decisions of firms and individuals to invest, including in innovation.

The various analyses of Brazil commonly cite weaknesses in transport and other physical infrastructures as a critical structural impediment to the country's economic and social development. It is also viewed that infrastructure improvements could considerably leverage the country's economic growth.

As Figure 5.1 shows, road and railway density in Brazil is less than half of the average for the rest of BRIICS, and by far below that of the key OECD economies (although such a comparison is limited given the differences in the countries' geographic conditions and development levels). The gap with the BRIICS and developed economies in terms of the quality of infrastructure is also considerable, as evidenced by the opinions of Brazilian businesses (Figure 5.2). They attribute low quality scores to all types of transport (around 3 points on a 7-point scale), with a particularly low evaluation for rail transport.

Figure 5.1. Brazil's availability of transport infrastructure, international comparison



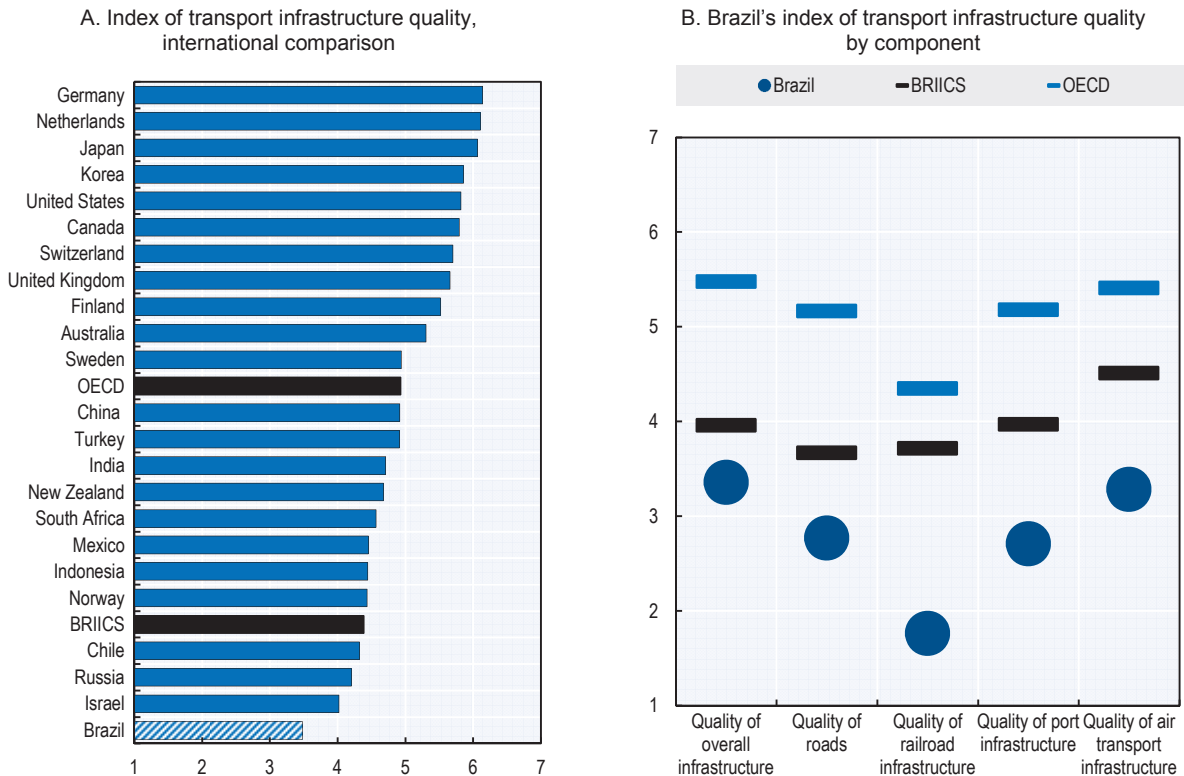
Export competitors are top 10 world exporters relative to Brazil's leading exports (Argentina, Belgium, Canada, China, France, Germany, India, the Netherlands, Spain and the United States). Data for road density refers to 2011.

Source: WDI (2013), *World Development Indicators Database*, <http://data.worldbank.org/data-catalog/world-development-indicators>.

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Figure 5.2. Global Competitiveness Index: Quality of transport infrastructure, 2013-14

Scale 1 to 7 (best)



Indices for BRIICS and OECD represent simple averages of member country indices.

Source: World Economic Forum (2013), *The Global Competitiveness Report 2013-2014: Full data Edition*, Geneva 2013.
<http://reports.weforum.org/the-global-competitiveness-report-2013-2014/#>.

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Underdevelopment of the Brazilian infrastructure is recognised by the government. Since the mid-1990s, it has undertaken important institutional and regulatory reforms in the infrastructure sectors, and in the mid-2000s public investment in infrastructure was significantly increased through various federal and state programmes. Governments at the federal and state levels also introduced various tax and credit incentives to increase private investment in infrastructure (Box 5.1).

The overall national policy on infrastructure development has important implications for the agro-food system. Several projects implemented by the Ministry of Transport and the Secretariat of Sea Ports are not specific to agriculture but have high potential to improve the capacity and the time involved in the handling and transport of agricultural commodities. This includes projects such as “Intelligent Logistic Chain,” “Port without Paper,” “Port 24 Hours,” and projects to improve port perimeter zones. Additional investments are foreseen as of 2013 to develop railroad and road networks; these projects will increase the flow of agricultural commodities because they enable better connectivity between producing and consuming regions and with neighbouring export markets. Other activities include the development of electronic systems to facilitate the control of shipments in ports and other border points. As of 2013, the National Rural Credit System provides a reduced-cost credit for the construction of private storage. It is also foreseen to invest BRL 1 billion (USD 463 million) annually between 2013 and 2017 in the construction of public storage (Government of Brazil, 2013).

Box 5.1. Reforms and investment in Brazil's infrastructure sectors

The neglect of infrastructure investment over the decades of economic instability led to the emergence of bottlenecks in almost all infrastructure areas. The Brazilian railway sector is underdeveloped and underexploited. Tight control by the federal government over tariffs up until the late 1980s resulted in severe underinvestment and low maintenance spending and even led to shrinkage of the railway network. The current need is to expand the network and improve its connectivity given the significant positive social and environmental externalities of railway transport. The road system is also inadequate to the country's needs. Although this network is one of the largest in the world, the share of paved roads is small. In 2010, it was estimated to be only 14%, compared to 23% in Chile and over 50% in China, India and Indonesia (WDI, 2013). Ports represent another constraint, with many suffering underinvestment, inefficient management of public operators and rigid rules for hiring temporary port labour. The backlog is particularly high in the areas of water and sanitation: only 47% of the population benefit from sewage collection and approximately 20% of collected sewage is treated. For the electricity sector, the most important challenge is to raise generation capacity to meet the demands of economic development and an increasing population. According to Morgan Stanley (2010), Brazil would need to invest around 4% of GDP annually into infrastructure over 20 years in order to catch up with the infrastructure levels of Chile, the best performer in Latin America.

Regulatory reforms in infrastructure sectors included the creation of administratively and financially independent sectoral federal regulatory agencies, as well as the strengthening of public decision-making and accountability processes. The scope for private participation in infrastructure projects has been broadened. Concession agreements were launched in the road sector and more recently, in the airport sector, and a significant expansion of concession contracts is foreseen. Another regulatory step to enhance investments in infrastructure projects was the introduction of a new regulatory framework for Public Private Partnerships in 2004. FDI related to some transport activities were liberalised.

State involvement in the infrastructure sectors was also changed, although to different degrees in different sectors. Railway transportation was privatised in the mid-1990s. In the electricity sector, however, initial privatisation efforts were curtailed in the aftermath of a major supply crisis. The state is currently a major shareholder, concentrating 80% of assets in power generation and around two-thirds of the electricity distribution assets. A regulated electricity market operates on a wholesale power pool which is allocated through competitive auctions between generators and distribution companies based on long-term contracts. There is also a small free market for large consumers who can deal directly with electricity generators. The telecommunications sector underwent considerable deregulation with the dismantling of the state-owned company *Telebrás*, and the creation of regional operators and expansion of the existing network to fulfil newly specified universal service obligations. The telecommunications market is separated today into two regimes. The fixed-line segment is subjected to a "public" regime and suffers from a lack of competition. The firms under this regime must achieve universal service targets, comply with price caps and service obligations. Firms operating under the "private" regime face minimum government intervention, free pricing, and no restrictions on FDI.

In 2005, a pilot infrastructure development project was launched. In 2007 it was replaced by a longer-term programme, the Accelerated Growth Pact (*Programa de Aceleração do Crescimento*, PAC). PAC's aim is to increase both private and public infrastructure investments, improve regulatory base and co-ordination of bodies involved in infrastructure policies. It is currently in its second phase. During the first phase (2007-10), BRL 657 billion (USD 352 billion) were spent and for the second phase (2011-14) the budget has been increased to BRL 989 billion (USD 512 billion). PAC's coverage is wide, with almost 48% of total planned expenditures for the second phase going to the energy sector, 29% to the housing, 11% to the transport sector, and the remaining 12% is destined for urban development, water and light infrastructure. Other federal investments are made within infrastructure programmes that are not included in the PAC.

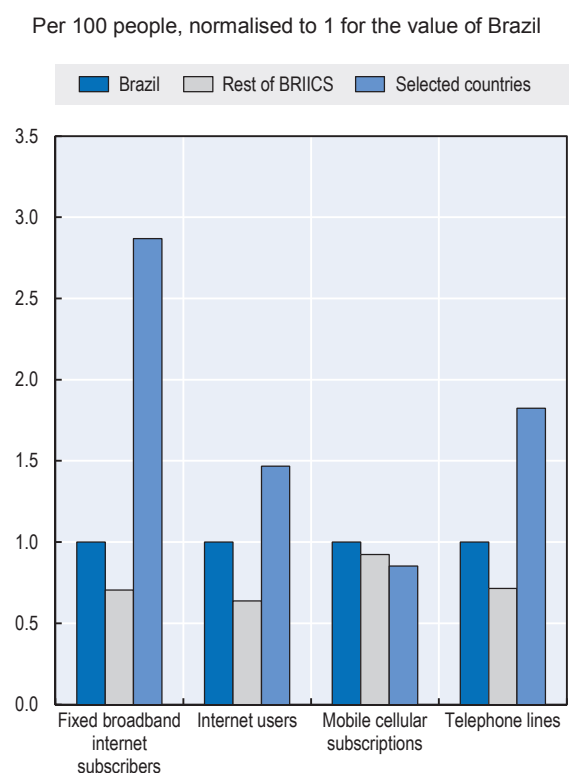
Source: OECD (2011 and 2013), *OECD Economic Surveys: Brazil*.

Information and communication technologies (ICT) have a distinct role in increasing innovation by speeding up the diffusion of information, facilitating networking, reducing geographic limitations and improving efficiency in communication. OECD analysis at the firm level shows that the probability to innovate increases with the intensity of ICT use. This is true for both manufacturing and service firms and for different types of innovation. Today, high-speed broadband networks support innovation as much as electricity and transport networks spurred innovation in the past; they dramatically change practices, extend innovation process beyond firms, government and researchers to consumers. Internet access is a prerequisite for using e-government services, and the data indicate a strong co-relation between penetration of the broadband infrastructure and the use of e-government services by citizens. The importance of ICT for innovation also comes from the fact that it improves basic competences of people and thus their capacity to create knowledge and uptake new products.

For example, OECD PISA results show that years of computer use is associated with higher student proficiency levels in science (OECD, 2010a).

Brazil has made impressive progress in ICT penetration, not least due to the considerable reforms undertaken in this sector. It is placed well ahead of the average for the rest of BRIICS by the share of internet and mobile telephone users and the density of internet and telephone networks (Figure 5.3). The gap with the average for selected OECD economies is much less than for the physical infrastructure and the spread of internet users Brazil even outperforms these selected economies. The perception of Brazilian businesses on the quality of electricity and telephony infrastructure are more favourable. They score it higher than the transport infrastructure, resulting in a higher international country ranking (4.57 points on a scale between 1 and 7 points), although there remains a significant quality gap with the best OECD performers (Figure 5.4).

Figure 5.3. Brazil's ICT penetration, international comparison, 2012

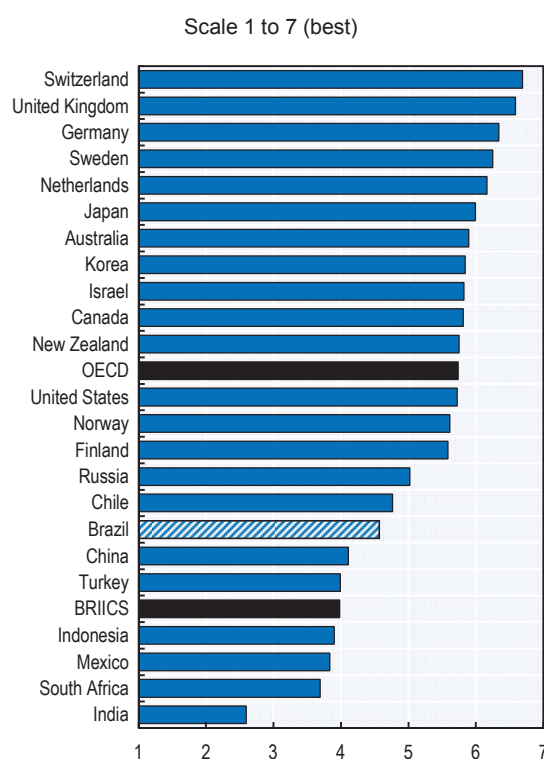


Selected countries are the 10 top commodity export competitors relative to Brazil's leading exports (Argentina, Belgium, Canada, China, France, Germany, India, the Netherlands, Spain and the United States).

Source: WDI (2013), World Development Indicators Database. World Bank, <http://data.worldbank.org/data-catalog/world-development-indicators>.

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Figure 5.4. Quality index of Brazil's electricity and telephony infrastructure, international comparison, 2013-14



Indices for BRIICS and OECD represent simple averages of member-country indices.

Source: World Economic Forum (2013), *The Global Competitiveness Report 2013-2014*. <http://reports.weforum.org/the-global-competitiveness-report-2013-2014/#>.

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Labour market policy

Labour regulations affect the cost and conditions of employing labour and thus production choices by firms and their incentives to invest in new products and processes. Labour income played a key role in reducing poverty and income inequality in Brazil, helped by a steady decline in unemployment. Under Brazilian labour regulations, the minimum wage is subject to the automatic indexation rule based on past inflation and increases in overall GDP (as opposed to per capita GDP). This rule is scheduled for a review in 2015 and needs to be adjusted to better connect wages to

labour productivity, while protecting the purchasing power of the minimum wage (OECD, 2013b). Since the early 2000s, the minimum wage has almost doubled, also driving up average wage levels. The minimum wage indexation, a relatively high tax wedge on labour, and the policy focus on consumption stimulus have contributed to a fast rise in labour costs in Brazil over the past decade.

Brazilian labour regulations are viewed as rigid and complex, and generally constraining to employers. These regulations are set out in 900 legislative articles, with some formulated decades ago and inscribed into the national Constitution. Labour regulations focus on conditions of work and pay, and are quite detailed. The rigidity of regulations sometimes restricts the establishment of mutually beneficial labour agreements, resulting in a discrepancy between common practice and the law, thus posing legal risks to companies. It is not uncommon that the interpretation of labour regulations by labour courts is surrounded by uncertainties and some sources highlight the considerable difficulties that Brazilian businesses face in complying with labour laws (The Economist, 2011).

Beyond the cost of labour, labour regulations also affect innovation through their impact on labour mobility. Innovative firms are likely to be more dependent on adequate conditions for hiring and dismissing people, complemented by good systems of unemployment insurance and support for job placement, skills improvement and continuous learning. Policy on international mobility of human resources, particularly of skilled people, affects the creation, diffusion, and uptake of knowledge and, as such, becomes one of the policy drivers enabling innovation.

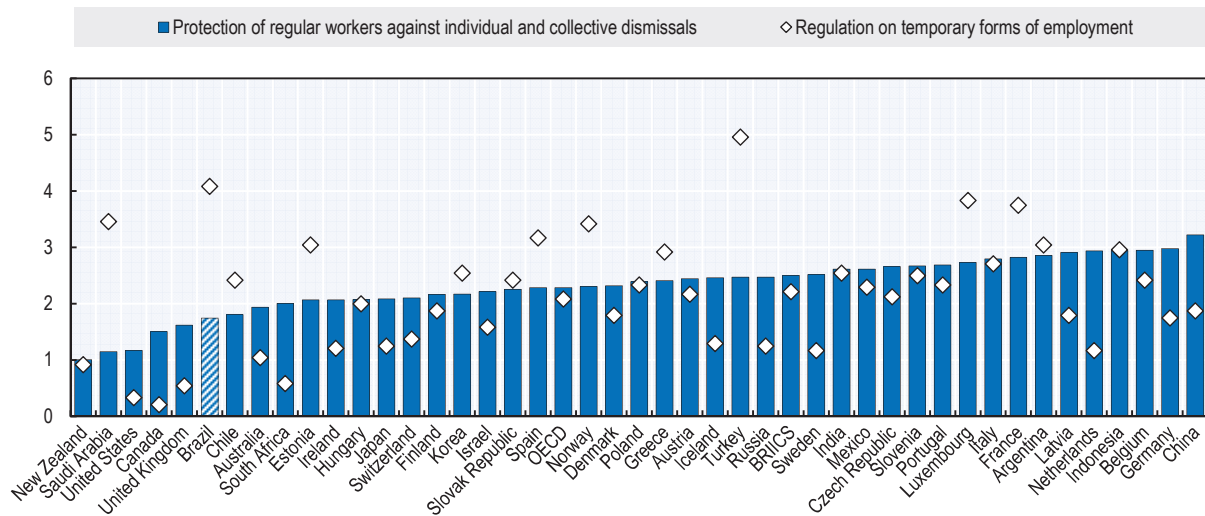
Employment protection regulations directly affect labour mobility. The OECD indicators of employment protection legislation measure the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers on fixed-term or temporary work agency contracts (Figure 5.5). Overall, Brazil's labour system is less focussed on employment protection compared to conditions of work and rewards. Among the countries covered, Brazil is the one with relatively limited restrictions on hiring and dismissal of permanent workers. The regime for temporary employment is rigid, scoring second highest after Turkey. However, the practical relevance of this may be low as employment protection of regular contracts is not particularly strong (OECD, 2013b).

Well-functioning employment programmes targeting those who lost jobs or face such a risk facilitate labour mobility. In the context of innovation, a balance between passive measures that provide temporary financial support to the unemployed and active measures oriented towards job placement, training, job rotation and sharing, employment and start-up incentives is of particular relevance.

Since the 1990s, the Brazilian government has made efforts to diversify the functions of the National Employment System (Sistema Nacional de Emprego, SINE)² to include, beyond compensation-based programmes, programmes to insert and re-insert job seekers into the labour market. At present, Brazil's employment programmes cover four areas: unemployment insurance; job placement through intermediation of government agencies; vocational training; and employment and income generation. There has been progress in strengthening the focus on insertion of workers into the labour market. However, the system remains dominated by unemployment insurance, both in terms of the number of workers covered and resources involved. Labour market insertion measures supported by skills improvement programmes seem to be inadequate in terms of the resources involved and their performance, whereas these measures could play an important role in labour market adjustment to support the innovation process.

Figure 5.5. OECD indicators of employment protection legislation, 2013¹

Scale from 0 (least) to 6 (most) restrictive



1. Data refer to 1 January 2013 for OECD countries and Latvia and 1 January 2012 for other countries.

Source: OECD (2013), *OECD Employment Protection Database*, www.oecd.org/employment/protection.

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Box 5.2. Main components of Brazil's labour policies

Job placement activity, one of the active labour policy areas, has had a mixed performance, at least based on the information available as of the late 2000s: while the number of workers placed by the agencies of the National Employment System has been increasing, it did not keep pace with the rise in job vacancies, which may reflect the rapid expansion of the Brazilian economy during the 2000s. Vocational training, another active labour policy area, is implemented within the National Plan for Social and Vocational Training. This Plan aims not only to serve the workers who resort to the National Employment System, but to address the needs of self-managed enterprises and beneficiaries of welfare programmes. Between 2003 and 2008, training through the National Employment System had a small outreach due to limited availability of funding. The number of workers who completed courses did not exceed 150 000 per year, far below the requirements of the National Plan for Social and Vocational Training. It was foreseen to increase the outreach of the training programmes beyond 2008, however no updated information is available at the time of writing. In addition to the National Plan for Social and Vocational Training, an important part of the training is implemented within a PROJOVEM programme aimed at young people, who account for over 60% of the unemployed.

Employment policy in Brazil also includes measures for employment and income generation using FAT funds to provide credit for business activities. In 2008, FAT financed 17 credit programmes for various activities and sub-sectors, including four programmes related to rural business. Of these four, the most important is PRONAF (Programa Nacional de Fortalecimento da Agricultura Familiar) which supports the development of "family" (smallholder) agriculture. Another important programme for employment and income generation is PRONAMP (Programa Nacional de Apoio ao Médio Produtor Rural), which provides loans to medium size and small farmers not eligible for credit through PRONAF. The focus of PRONAF and PRONAMP, respectively, on small and medium-sized businesses implies that these programmes can be considered as important instruments that can potentially increase innovation by prioritising innovative businesses.

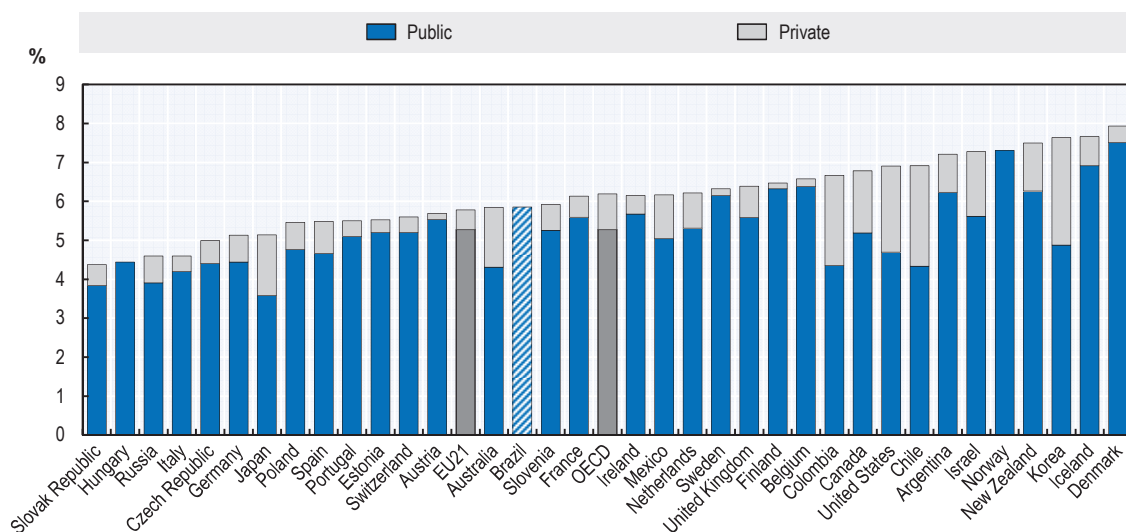
Source: Gonzales, R. H. (2010), "Employment Policies in Brazil: History, Scope and Limitations".

Education and skills policy

Education policy has strong and diverse links to innovation. A high level of general and scientific education facilitates acceptance of innovations by society at large. Effective innovation systems require well-educated researchers, teachers, extension officers and business, and producers with a good general, technical and business education would generally be more willing and better skilled at adopting innovations.

Nation's education improvement became a policy priority in Brazil in the 1980s, and was seen as a prerequisite to achieving social progress as well as an investment in future development. Between 2000 and 2011, the increase in public expenditures on education outpaced those in almost all OECD countries. Per student spending in primary and secondary education was more than doubled over this period, and was also increased for tertiary education but only slightly as expenditures were allocated across a nearly doubling of student numbers. By the share of national wealth directed towards education, Brazil has been rapidly catching up with OECD countries; between 2000 and 2011, expenditure on education increased from 3.5% to 5.9% of GDP compared to OECD average of 6.1% (Figure 5.6).

Figure 5.6. Public and private expenditure on educational institutions as a percentage of GDP, 2011



Public expenditure includes public subsidies to households attributable for educational institutions, and direct expenditure on educational institutions from international sources. Private expenditure is net of public subsidies attributable for educational institutions. Data for Canada refer to 2010; data for Chile refer to 2012.

Source: OECD (2014a), *Education at a Glance 2014: OECD Indicators*, <http://dx.doi.org/10.1787/eag-2014-en>.

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The focus since the mid-1990s was to ensure a mandated level of spending on education by establishing a per student spending floor for the entire country. Special funds were created to redistribute resources within the states so that all municipalities could reach the per student spending requirement. The municipalities that could not reach the national spending floor also received top-ups from the federal government. The efforts to increase financing for education were complemented by the establishment of incentives for good performance at the local level, supported by the introduction of uniform nation-wide tests to measure student attainments and school performance. The ability to monitor progress at the school level in a comparable manner was a major achievement and was very helpful in linking funding with performance improvements of the education system. Another important direction was the substantial increase in conditional cash transfer programme *Bolsa Familia* (initially, *Bolsa Escola*) which created both incentives and the means for poor parents to send their children to school (De Mello and Hoppe, 2005; OECD, 2011).

Increasing options for vocational training through supply of shorter tertiary-education programmes with a more practical focus is an important goal, especially in the rural context. This has recently received much attention, with enrolment in vocational training more than doubling since the early 2000s. In 2011, a federal programme PRONATEC was launched and now covers 8 million students. Its objective is to expand the federal network of technical schools, with a particular focus on providing opportunities to students from poor backgrounds through free training places, loans and

bursaries (OECD, 2013b). Since 2013, it includes a component targeted to rural youngsters: PRONATEC Countryside.

Agricultural education has seen a particular expansion during the agricultural boom in Brazil which increased demand for qualified professionals in the public sector, enterprises, and a number of young farmers wishing to improve the technological level of their business. For example, in university education, the number of agricultural courses for bachelor degrees reached 830 in 2011, a six-fold increase over 1991, which covers only full-time studies, and does not include distance courses or MBAs (Table 5.1). The number of graduates nearly quadrupled, with the strongest increases occurring in the 2000s. General crop and livestock production disciplines concentrated the largest proportion of courses and students, followed by veterinary. The forest engineering and fishing disciplines are gaining in importance.

Table 5.1. Number of university courses and graduates in agricultural sciences¹

Disciplines	Number of courses			Number of graduates, '000s		
	1991	2000	2011	1991	2000	2011
Forest engineering and silviculture	16	21	65	0.2	0.3	1.5
Horticulture	-	2	6	-	-	0.016
Crop and livestock production	86	156	542	3.4	4.0	10.9
Fishing resources	4	7	39	0.032	0.056	1.9
Veterinary	33	90	178	1.4	2.8	6.7
Total agriculture and veterinary	139	276	830	5.1	7.2	19.5

All data refer to bachelor degree studies.

Source: MEC/INEP (2013), *Cursos em ciências agrárias 2000-2011*.

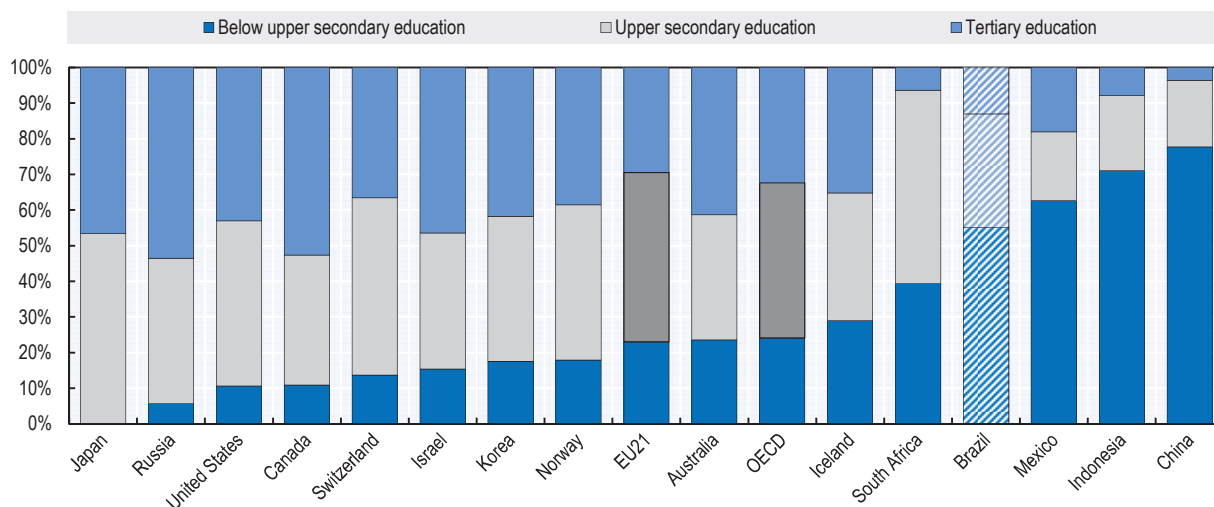
Supply of agricultural education has become more evenly distributed across country regions, but it is still concentrated in the Centre-South. For example, the State of São Paulo hosts four prominent universities in Agricultural Sciences: Universidade de São Paulo (USP), Universidade Federal de São Carlos (UFSCar), Universidade Estadual Paulista “Julio Mesquita Filho” (Unesp) and Universidade Estadual de Campinas (Unicamp). The supply of courses in general has been following market needs, but requires continuous adaptation to industry demand (Contini and Dias Avila, 2014).

Brazil’s active education policies enabled impressive progress in access to education, particularly for poor people, improved population’s education attainments, and student performance. Still, there is yet a considerable gap to fill. As illustrated in Figure 5.7, the share of the country’s 25-to 64-year-olds who attained at least an upper secondary or tertiary education is notably smaller than in the majority of OECD countries (45% compared to an OECD average of 76%) and some BRIICS (Russia and South Africa). Of those who received an education below the upper secondary level, nearly three-quarters have only pre-primary or primary education.

The OECD Programme for International Student Assessment (PISA) registers significant advancement in performance by Brazilian 15-year old students since 2003. This progress is particularly important in mathematics, where the country has shown the largest gains among the 65 countries and economies covered by the survey; significant progress is also found in reading and science. Depending on the area, the advancement can either largely or entirely be explained by improvements in the economic, social and cultural status of the student population. However, student performance in Brazil still lags far behind the average of OECD and BRIICS countries, with the gap being more significant for rural students (Figure 5.8). The average scores for Brazilian 15-year old students in all three areas of knowledge – mathematics, reading, and science – lagging behind their peers in OECD countries by one proficiency level. The share of top-performing students in mathematics is 0.8% for Brazil, compared to an OECD average of 12.6%.

An additional perspective of Brazil’s education performance can be obtained from business perceptions on its various dimensions, measured by the WEF’s Global Competitiveness Index as it pertains to education and training. This Index ranks the country below the majority of OECD countries and some of the BRIICS countries (Figure 5.9.A). This overall low score reflects the low appreciation of the quality of Brazil’s education by the Brazilian business community. It, however, considers that the availability of education and on-job training, above the average levels of the rest of the BRIICS and somewhat closer to the average OECD levels (Figure 5.9.B).

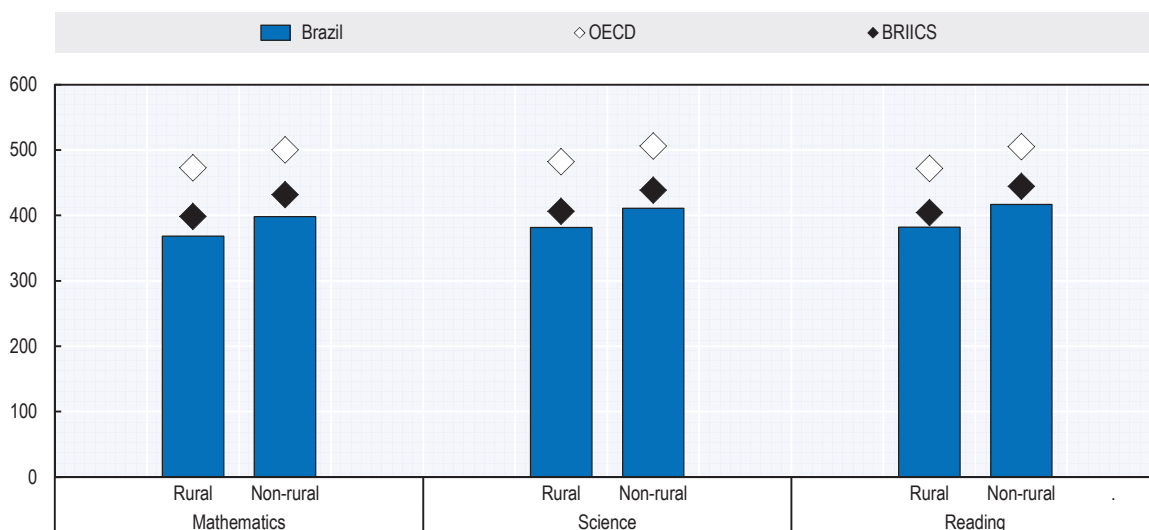
Figure 5.7. Education attainments of Brazil’s population, international comparison, 2012
Percentage distribution of population between 25 and 65 years of age



Countries are ranked by the percentage of population with education below upper secondary level. Data for Indonesia represent 2011 and for China represent 2010. EU21 refers to EU countries member to the OECD.

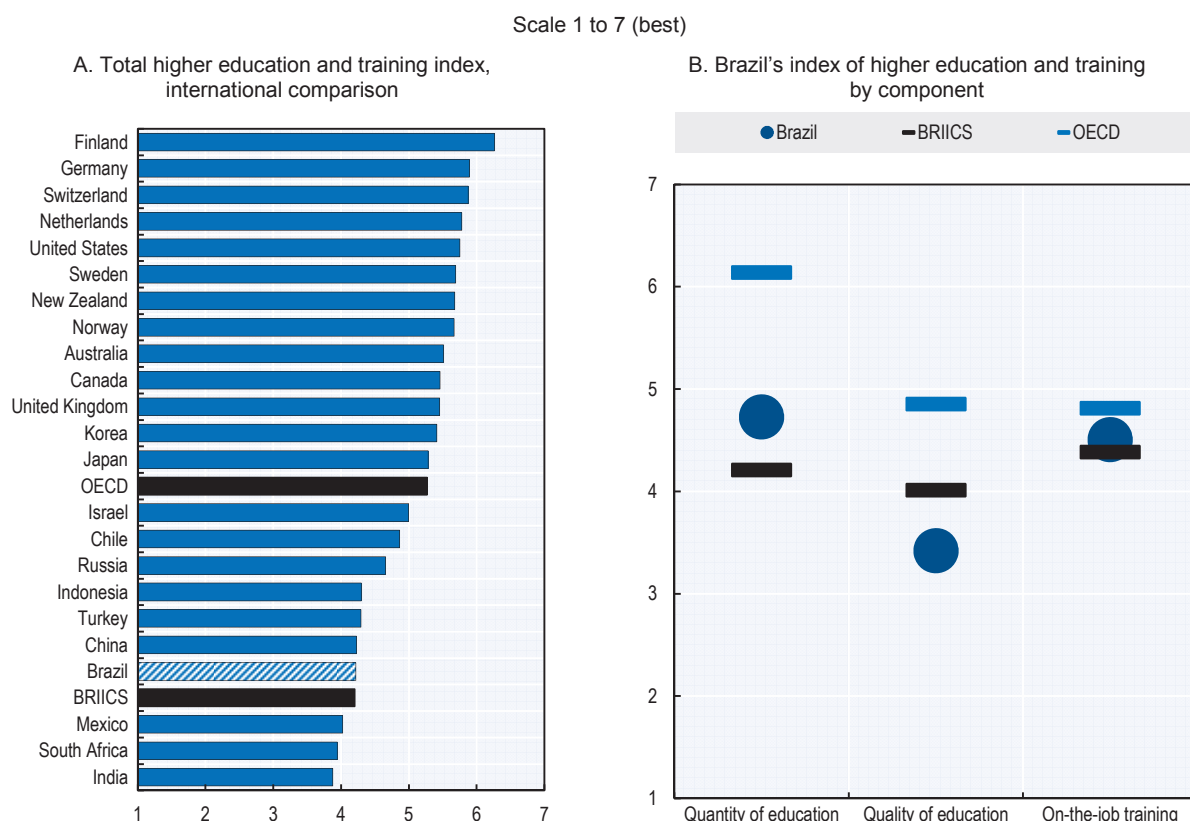
Source: OECD (2014a), *Education at a Glance 2014: OECD Indicators*, <http://dx.doi.org/10.1787/eag-2014-en>.
StatLink <http://dx.doi.org/10.1787/888933242570>

Figure 5.8. PISA assessment of 15-year old students’ performance in mathematics, reading and science, 2012
Mean performance scores



Rural includes villages and small towns.

Source: OECD (2014b), *OECD Programme for International Student Assessment (PISA) database* <http://www.oecd.org/pisa/>.
StatLink <http://dx.doi.org/10.1787/888933242587>

Figure 5.9. Global Competitiveness Index: higher education and training, 2013-14

Indices for BRIICS and OECD represent simple averages of member-country indices.

Source: World Economic Forum (2013), *The Global Competitiveness Report 2013-2014*. <http://reports.weforum.org/the-global-competitiveness-report-2013-2014/#>.

StatLink  <http://dx.doi.org/10.1787/888933242597>

Two recent OECD *Economic Surveys for Brazil* (OECD, 2011; OECD, 2013b) distinguished the advancement in education among the priorities for growth in Brazil, and highlighted that policy should focus on improving the quality of education. The challenge facing Brazil in this area is largely rooted in the fact the quality of instruction and teachers lagged behind the growing number of students involving large teachers' hiring over a relatively short period of time. The policies should be oriented at setting uniform standards for teachers, funding of teachers' training and learning materials, linking teachers' pay with performance more strongly rather than with the seniority status. Other issues concern reducing grade repetition (e.g. one of the highest for the 15-year olds across 2012 PISA survey) and the drop-out rates in the secondary education.

Notes

1. This section draws on Chapter 3, “Promoting infrastructure development” of *OECD Economic Surveys: Brazil* (OECD, 2011).
2. Brazil’s National Employment System is financed from the Fund for Worker’s Support (*Fundo de Amparo ao Trabalhador*, FAT), accumulating various turnover and revenue taxes and payroll contributions. As noted in Section 3.4 on financial policy, FAT funds are also used to capitalise the National Bank for Economic and Social Development. Thus, as of late 2000s, only around one half of FAT’s revenue from tax and payroll collections was directed to the National Employment System (Gonzales, 2010).

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