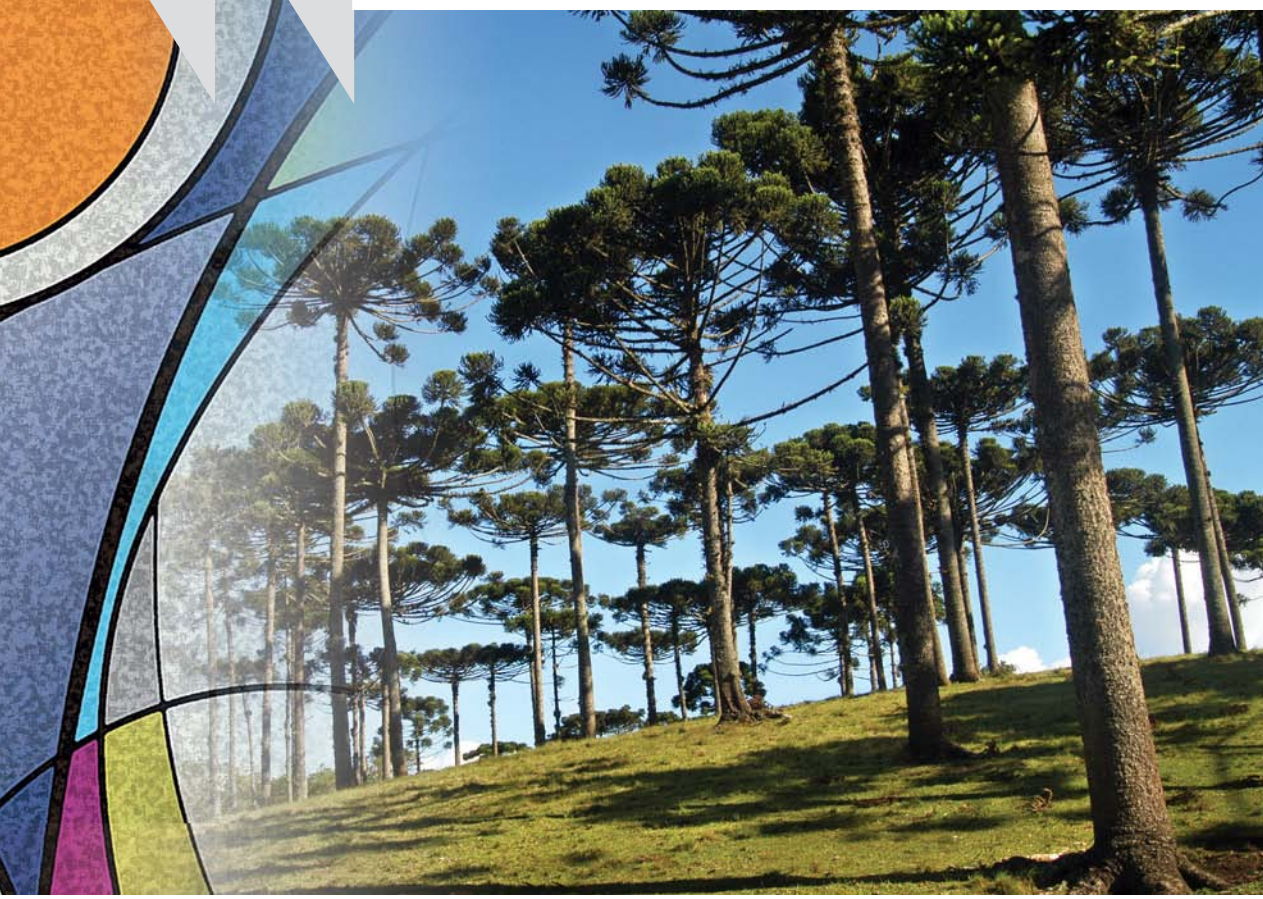
Higher Education in Regional and City Development

State of Paraná, Brazil



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Higher Education in Regional and City Development

State of Paraná, Brazil 2011

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Foreword

Universities and other higher education institutions can play a key role in human capital development and innovation systems in their cities and regions. Reviews of Higher Education in Regional and City Development are the OECD's vehicle to mobilise higher education for economic, social and cultural development of cities and regions. The reviews analyse how the higher education system impacts local and regional development and help improve this impact. They examine higher education institutions' contribution to human capital and skills development; technology transfer and business innovation; social, cultural and environmental development; and regional capacity building. The review process facilitates partnership building in regions by drawing together higher education institutions and public and private agencies to identify strategic goals and work together towards them. To know more about the OECD review process and requirements, visit Higher Education and Regions' website at *www.oecd.org/edu/imhe/regionaldevelopment.*

These reviews are part of a wider multi-annum work of higher education in cities and regions co-ordinated by the OECD Programme on Institutional Management in Higher Education (IMHE). In 2004-07, the OECD/IMHE conducted an extensive study with 14 regional reviews across 12 countries. This resulted in the OECD flagship publication *Higher Education and Regions: Globally Competitive, Locally Engaged* (OECD, 2007) with recommendations to benefit both higher education institutions and national and regional governments. In 2008, the OECD/IMHE launched a second series of OECD Reviews of Higher Education in Regional and City Development to address the demand by national and regional governments for more responsive and active higher education institutions. As a result, 14 regions in 11 countries participated in the OECD review process in 2008-10. The reviews were carried out by the OECD/IMHE in collaboration with international organisations and associations and other OECD programmes and directorates. This work also supports the OECD Innovation Strategy and OECD Green Growth Strategy.

This OECD review of the State of Paraná, Brazil is part of the second round of OECD reviews of Higher Education in Regional and City

Development and a follow-up to the review of Northern Parana in 2005-07. There has been an important cultural change since the first OECD review visit. Today, higher education leaders in Paraná are more willing to collaborate with their regional stakeholders in the public and private sector. This shows promise for a new phase of regional development in Paraná.

Acknowledgements

Numerous national and regional stakeholders and representatives of higher education institutions provided valuable insights and comments during the review visit. The OECD would like to thank in particular the leadership and staff of the Federal University of Paraná (UFP), the Federal Technological University of Parana (UTFPR) and Pontifical Catholic University of Paraná (PUCPR) who participated in the review process and opened their doors to the OECD review team; the regional co-ordinating team Cassio Rolim and Mauricio Serra as well as other active local counterparts for this review, including Agencia Curitiba, the Federation of Industries of the State of Paraná (FIEP) and the small business company SEBRAE (*Serviços de Apoio à Pequena Empresa no Paraná*).

This publication draws on interviews carried out during a week-long review visit from 6 to 12 December 2009, on the findings of the State of Paraná's Self-evaluation Report and using additional information provided to the review team. The OECD review team had a full programme and were received openly by a wide range of stakeholders. However, it is also necessary to note the limitations of this report. The review team visited only a small number of higher education institutions in Paraná; only one private higher education institution, the Pontifical Catholic University of Paraná, participated in the self-evaluation and OECD review phase, while none of the state universities in Paraná took part in the review.

The peer review visit was co-ordinated by Ernesto Flores, a Mexican national seconded from Sonora Institute of Technology (ITSON) to the OECD/IMHE for a 15-month period. This publication was co-ordinated by Jaana Puukka (OECD/IMHE) with the support from Oscar Valiente (OECD/IMHE), Austin Delaney (OECD/IMHE), Philip Wade (former OECD Secretariat), José-Ginés Mora (University of London/Valencia University of Technology, Spain) and Carlos Roberto Azzoni (University of São Paulo, Brazil). In addition, Salvador Malo (Mexican Competitiveness Institute, Mexico) participated in the review visit. Further details about the review team can be found in Annex 1 of this report. Rachel Linden supervised the publication process. Freya Damrell provided support in the final editing phase.

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List of acronyms

ACAFE	*Sistema ACAFE* System of improving HE teaching skills
APLs	Local productive systems
CAPES	*Coordenação de Aperfeiçoamento de Pessoal do Ensino Superior* Coordination for the Improvement of Higher Education
CCT	*Coordenadora de Ciencia e Tecnologia* Coordination of Science and Technology
CEE-PR	*Conselho Estadual de Educaçao do Parana* Parana State Council for Education
CES	*Coordenadoria de Ensino Superior* Coordination of Higher Education
CEUMAR	Centro Universitario de Maringa University Centre of Maringa
CIEE	*Centro para Integração Empresa Escola* Centre for the Integration of Schools and Business Sectors
CNDI	*Conselho Nacional de Desenvolvimento Industrial* National Council for Industrial Development
CNE	*Conselho Nacional de Educação* National Council for Education
CNI	*Confederação Nacional da Indústria* National Confederation of Industries
CNP	*Conselho Nacional de Desenvolvimento Científico e Tecnológico* National Council for Scientific and Technological Development
CODINES	*Conselho de Dirigentes de Instituiçoes de Ensino Superior* Management Council of Higher Education Institutions
ENADE	*Exame Nacional de Desempenho de Estudantes* National examination of student development
FEPAR	*Faculdad Evangelica do Parana*
FIEP	*Federação das Indústrias do Estado do Paraná* Federation of Industries of the State of Paraná
FPP	*Faculdade Pequeno Príncipen*

GDP	Gross Domestic Product
GEP	Government of the State of Paraná
GFAL	*Global Forum América Latina* The Global Forum Latin America
HE	Higher education
HEI	Higher education institution
IDH-M	*Índice de Desenvolvimento Humano-Municipal* Human Development Index- Municipal
IEL	*Instituto Euvaldo Lodi* Euvaldo Lodi Institute
ILAPEO	*Instituto Latino Americano Pesq e Ens Odontologico* Latin American Institute of Dentistry
IMEA	*Instituto Mercosul de Estudos Avancedos* Mercosul Institute of Advanced Studies
IMHE	OECD Programme on Institutional Management in Higher Education
IPARDES	*Instituto Paranaense de Desenvolvimento Econômico e Social* Paraná Institute for Economic and Social Development
LACTEC	*Instituto de Tecnologia para o Desenvolvimento* Institute of Technology for Development)
NITPAR	*Núcleo de Inovação Tecnológica do Paraná* Network of Technological Innovation of Paraná
OECD	Organisation for Economic Co-operation and Development
PNAD	*Pesquisa Nacional por Amostras de Domicílios* National Household Survey
PPP	Public-private partnership
PROUNI	Universidade para Todos University for all grant programme
PTI	*Parque Tecnologico de Itaipu* Itaipu Technological Park
PUC	*Pontifícia Universidade Católica* Pontifical Catholic University
PUCPR	*Pontifícia Universidade Católica Do Paraná* Pontifical Catholic University of Paraná
R&D	Research and Development
REUNI	*Programa de Apoio a Planos de Reestruturação e Expansão das Universidades Federais* Programme of Support for the Restructuring and Expansion of Federal Universities
SEBRAE	*Serviços de Apoio à Pequena Empresa no Paraná* Brazilian Support Service for Micro and Small Companies

SENAI	*Serviço Nacional de Aprendizagem Industrial* National Service of Industrial Apprenticeship
SESI	*Serviço Social da Indústria* National Department for Industrial Social Service
SETI	*Secretaria de Estado da Ciência, Tecnologia e Ensino Superior* Secretariat of State for Science, Technology and Higher Education
STI	Science, technology and innovation
TECPAR	*Instituto de Tecnologia do Paraná* Technology Institute of Paraná
UAB	*Universidade Aberta do Brasil* Open University of Brazil
UDESC	*Universidade do Estado de Santa Catarina* State University of Santa Catarina
UEL	*Universidade Estadual de Londrina* State University of Londrina
UEM	*Universidade Estadual de Maringá* State University of Maringá
UENP-FUNDINOPI	*Universidade Estadual do Norte do Paraná -Faculdade Estadual de Direito do Norte Pioneiro* Northern Paraná State University Law Faculty
UEPG	*Universidade Estadual de Ponta Grossa* State University of Ponta Grossa
UFFS	*Universidade Federal da Fronteira Sul* Federal University of the Southern Frontier
UFRJ	*Universidade Federal do Rio de Janeiro* Federal University of Rio de Janeiro
UNDP	United Nations Development Programme
UniBrasilL	*FaculdadesIntegradas do Brasil*
UNICENP	*Centro Tecnológico Universidade Positivo* *Positive University technical centre*
UNICENTRO	*Universidade Estadual do Centro-Oeste*
UNICURITIBA	*Centro Universitário Curitiba*
UNIDO	United Nations Industrial Development Organisation
UNIFAE	*FAE Centro Universitário*
UNILA	*Universidade Internacional de America Latina* International University of Latin America
UNINDUS	*Universidade da Indústria*

UNINGÁ	*Faculdade Ingá* *Ingá Faculty*
UNIPAR	*Universidade Paranaense*
UNIOSTE	*Universidade Estadual do Oeste do Paraná* State University of the West of Paraná
UNOPAR	*Universidade Norte do Paraná* University of Northern Paraná
USF	*Universidade sem Fronteiras* University without Borders
USP	*Universidade de São Paulo* São Paulo University
USPTO	United States Patent and Trademark Office
UTFPR	*Universidade Tecnológica Federal do Paraná* Federal Technological University of Paraná
UTP	*Universidade Tuiuti do Paraná*

Assessment and recommendations

Towards a region that reaps rewards from investment in human capital development and innovation

Brazil enjoys great natural wealth and development potential. In recent years, the country has made progress not only in economic development, but also in education. Despite this progress, educational attainment levels and the R&D intensity remain low. Education plays a key role in the development of Brazil having a population of around 200 million, of which 60% are under 30 years of age. For both equity and competitiveness, improvement of human capital needs to be a priority for the Brazilian government.

With 10.6 million inhabitants, Paraná is one of the most prosperous states of Brazil, representing 5.62% of the country's total population, 6% of the Brazilian Gross National Product and 6.5% of the national GDP. However, the share of Paraná in Brazil's GDP has been eroding in recent years. In terms of per capita wealth, it ranks 7th among the 26 Brazilian states, slightly above the national average. Paraná's economy is export-oriented. It represented 8% of Brazil's exports in 2008. The state economy relies on industry (40.7%), commerce (27.3%), services (14.4%) and agriculture (17.6%). The Curitiba metropolitan region, with its well functioning urban development strategy, has a high concentration of urban industrial activities, while the rest of Paraná is characterised by a strong agri-business sector. Paraná has big productive firms on one hand and on the other a wide array of small and medium-sized enterprises, which represent the majority of employment. The few leading-edge companies tend to be located in Curitiba and controlled from outside the country. There are few spill-overs from big firms in terms of job creation, but supply chains are well-developed in the automotive industry and agri-business. In this context, Paraná faces a triple challenge:

- How to strengthen Paraná as an internationally attractive place to live, work, invest and study in the face of growing global competition?

- How to promote new business formation and support the development of the existing industry and SMEs?
- How to address the problems of poverty and inequity by creating opportunities for growth?

Human capital development in Paraná

Paraná represents an important concentration of human capital development with a large, diversified and geographically well-distributed higher education sector and a rapidly growing student population with high potential for innovation.

Paraná has a large, diversified and geographically well-distributed higher education sector. In 2008, there were 178 higher education institutions, of which 22 were public and 156 were private. Half of the total number of institutions and 89.5% of state higher education institutions in the southern region of Brazil are located in Paraná. Since 2009, Paraná has ten public universities – four federal and six state institutions – and five private universities.

The higher education scene is dominated by federal and state universities. The Federal University of Paraná (UFPR) is the oldest university in Brazil, created in 1912, while the Federal Technological University of Paraná (UTFPR), originally a technical training school, gained university status in 2005. In addition to the main campus in Curitiba, the Federal University of Paraná has two other locations: in Paranágua (Universidade do Litoral); and in the interior of the country (Palotina). Total enrolment of the three campuses is around 25 000 with an annual intake of 5 421 students (2009). Federal Technical University of Paraná has a wide territorial spread, with 11 campuses. In 2008-09, it had 16 840 students and 1 393 professors, offering a wide variety of post-graduate, graduate and vocational training courses. In 2009, two new federal universities were established: UNILA, the International University of Latin America (*Universidade Internacional de America Latina*) in Foz do Iguaçu and the Federal University of Southern Border (UFFS) in Laranjeiras do Sul. The Federal Government also maintains four technical institutes in Paraná (Curitiba, Paranágua, Foz de Iguaçu and Londrina), with four more planned to open in 2010.

The student population in Paraná is close to 330 000 (329 741) as compared with 316 496 in 2007, of the approximately 5.5 million students in

Brazil. Around one-third of the students were enrolled in public institutions and of those, two-thirds in state institutions. In fact, the most distinguishing feature of higher education in Paraná is the size and importance of the state-owned higher education sector. As elsewhere in Brazil, due to very competitive admission to public universities, the private sector enrols by far the highest number of students, which is increasing every year. Around 66% of total enrolment is in private institutions, with 52% in for-profit organisations. Between 1991 and 2007, higher education enrolment in Paraná rose by 6.6% per year, exceeding the average population growth and the increase in 15-24 year cohort (0.65%).

A key determinant to equity in access to and success in higher education lies in the quality of primary and secondary education systems. Access to and success in higher education remains a challenge to many students who are disadvantaged due to their socio-economic background and inadequate preparation in primary and secondary education.

The quality of the pre-university education system determines how well students are prepared to take admission tests and how they progress in higher education. In 2008, only 5% of all students in Brazil came from 40% of the poorest households, and almost all went to fee-charging private institutions. Over 90% of the students in public universities came from 40% of the richest households and nearly three-quarters came from the 20% of the richest households. The admission examinations to universities tend to be biased in favour of students from private high schools who have considerable advantage in entering federal and state universities that both offer free tuition.

Improvements in education at the primary and secondary level are necessary to better prepare all students. Taking into account the young age profile of Brazil, public spending on education per student is low at primary and secondary education. Students' learning outcomes are poor. While students in Paraná achieve above average results in national testing, international comparisons show a considerable gap to be bridged both for students in Brazil and Paraná, indicating that there is considerable scope for improvement in the quality of teaching.

It is up to school authorities to work towards improving the quality of education in Brazil and Paraná. At the same time, universities and other higher education institutions can and should reach out to local schools to improve the preparation for higher education. Some initiatives are already in

place. For example, the Federal University of Paraná has developed the Educational Development Programme (PDE), in partnership with the State Secretary for Education (SEED), to collaborate with teachers from the public education network in Paraná (RIEP). Recently, the Federal Government and federal universities have agreed on having further education schemes for teachers. These initiatives focus on the improvement of teachers' discipline-based knowledge rather than their pedagogical skills. There is scope for long-term multi-stakeholder collaboration to improve learning outcomes at schools. Successful international examples in this domain include the Access and Success programme at the University of Victoria in Australia and the El Paso Academic Collaborative in El Paso, Texas, which have both achieved measurable success in widening access and improving success rates of low income students.

The rapid increase in higher education enrolment has contributed to high dropout rates, particularly in private institutions. Throughout Brazil, 20.9% [10.5% (public) 24.5% (private)] of all students drop out before completing a degree, in comparison with the OECD average of 29.6%. There are many reasons for educational failure: insufficient preparation of students in primary and secondary education; inadequacies in the university admission systems; quality issues; need to combine work and study; inflexible curricula; and outdated classroom practices. In Paraná, there is limited data on higher education drop-out rates and students' academic progress both at the state and institutional level.

Concerns of academic failure are not high on the agenda of Paraná's higher education sector. As a result, there is little academic and social support for students. Financial support has improved over recent years, but more is needed. The Federal Government's ProUni and Student Financing Programme (FIES) are the main sources of support for needy students, in addition to individual scholarship schemes run by the state and individual universities. ProUni has been in operation since 2005 and is aimed at placing academically qualified low-income students in private higher education institutions. In Paraná, in the first semester of 2009, a total of 9 483 ProUni scholarships were offered to students, of which 5 615 were equivalent to full tuition. In the first semester of 2010, scholarships rose to 14 357 (522 in full tuition), representing over 6% of enrolment in private higher education institutions. The Student Financing Programme (FIES), initiated in 1999 (replacing the previous loan scheme), provides loans to needy students who are not beneficiaries of ProUni to cover up to 50% of their tuition costs, while students who are beneficiaries of ProUni can receive a loan of up to 25% of their tuition costs. The State of Paraná also has a number of scholarships and research funds that are specifically targeted to needy students.

Despite the wide range of higher education institutions and financial support, access and success in higher education remain a challenge to many students who are disadvantaged due to their low socio-economic background and inadequate preparation in primary and secondary education. The federal government should review the student funding system, along the lines proposed in the previous World Bank review (Salmi, and Fèvre (2009). The state authorities in Paraná are recommended to review the state-level student aid programmes with a view to easing financial burden on attending higher education and ensuring that all needy students have access to financial aid. The higher education sector is encouraged to develop more relevant academic, social and financial support to ensure success in education.

The state and federal governments have supported the expansion of higher education through collaborative extension activities as well as new campuses and institutions to reduce the geographical and social barriers to higher education. Notable initiatives include a university extension programme, "University without Borders" and the Federal Government's REUNI programme. The International University of Latin America, UNILA, represents an opportunity to strengthen the international position of a growing agri-business and tourism sectors.

In 2007, the State of Paraná launched the "University without Borders" (*Universidade sem Fronteiras*, USF) to enhance regional engagement of universities and social inclusion of vulnerable population groups. Today, USF is present in 120 municipalities, which represents about 30% of the towns in Paraná. This initiative, based on collaboration between the public universities in Paraná, aims to increase higher education participation in the most lagging areas of Paraná. It offers undergraduate education and professional development based on the needs of the region (family-farming and dairy production, agro-ecology, community development, etc.). By the end of 2010, the state government had invested BRL 40 million in USF. Multidisciplinary teams of academics, professionals and students work with associations, co-operatives and NGOs to develop projects in support of public policies and disseminate knowledge to the low income citizens. The University without Borders experience should be recorded, monitored and evaluated.

The Federal Government's REUNI programme has helped enlarge federal universities' student enrolment, bring in new faculty and improve facilities. For example, the Litoral campus of the Federal University of Paraná (UFPR), on the coast of Paraná was established in 2005 with the help of REUNI funding. Its undergraduate and professional education is aligned with local needs, featuring agro-ecology, environmental management, tourism, nursing and community development, etc. Thanks to REUNI funding, the UFPR Palotina campus, which focuses on agro-biology, has recently expanded greatly, increasing its enrolment five to six-fold.

The new International University of Latin America (UNILA) was established in 2009 in Foz do Iguaçu, next to the ITAIPU Technology Park and a state university (UNIOESTE) campus. With growing tourism activities, it is located at a strategically important crossroads between three countries and in the proximity of growing agri-businesses. This multinational venture, supported by the Federal University of Paraná, aims to attract 10 000 students and 300 faculty, half from Brazil and half from other Latin American countries. Teaching will be in both Portuguese and Spanish. Studies will included cross-border impact particularly in tourism and social studies and will capitalise on the cutting-edge research in environmental protection, water resources management and renewable energies conducted in the technology park. The Mercosul Institute of Advanced Studies (IMEA) was created as part of the project focusing on natural resources management, social studies and cross-border development and integration. The first 1 000 students began their studies in 2010. Consideration could be given whether this ambitious project would benefit from widening the recruitment also outside of Latin America and expanding its language requirements to include English. All students and faculty will need to improve their language skills if Paraná would like to position itself in the global market as an internationally attractive place to live, work, invest and study.

For education to be more relevant to the labour market and to boost entrepreneurship, education programmes should be aligned with regional needs and focus on students' learning process and outcomes.

Several larger higher education institutions in Paraná concentrate primarily on national labour markets and career-focused education provision. Higher education institutions should move towards more demand-led education provision, to better develop student competencies and build stronger links between higher education institutions and the labour market.

A wide range of measures could help, including credit-bearing work-based and co-operative learning for students, introducing problem-based learning methods in collaboration with local industry and other employers, as well as employer participation in the curriculum and course design. In addition, using local private sector employees as instructors and supporting mobility of university researchers/teaching staff temporarily to the private sector would be useful ways of improving labour market relevance. Finally, more data is needed on students' employment outcomes and graduate destinations.

Encouraging steps have been made in aligning education provision with regional needs. For example, the Federal University of the Southern Border concentrates on agronomy, aquaculture, rural development, agro-industrial management and food engineering. The Federal Technological University of Paraná (UFTPR) is known for its commitment to close alignment with industry needs, mandatory work placement for all students and specific locally-based university programmes. The leading private institution, Pontifical Catholic University (PUCPR), has a regional vocational mission and also provides community service learning opportunities for students. Despite the progress made, positive developments to improve labour market relevance are taking place only in a handful of institutions. Initiatives to improve labour market relevance in higher education remain in most instances discipline-based and/or driven by individual academics. As a result, only a small proportion of students benefit from innovative approaches.

Due to rapidly changing skill requirements, up-skilling, re-skilling and other forms of lifelong learning are becoming increasingly important. To date, higher education institutions in Paraná are still geared more towards meeting the needs of traditional students than those of adult learners. While public universities face internal constraints due to the introduction of fees for lifelong learning activities, their efforts are also targeted narrowly to adult learners with university degrees. Currently, there are no mechanisms to recognise prior informal or non-formal learning. While the higher education institutions are aware of adults' needs and have some programmes in place for them, not enough strong data is available to understand the needs of this population or the efficacy of higher education in meeting them. The Federation of Industries in Paraná (FIEP) conducted a review of the skills needed in the Paraná region, but this was a one-off study. Flexible ways of provision should be scaled up to benefit non-traditional learners who often combine work and study.

Finding ways of increasing entrepreneurship could be an effective strategy to create jobs. Higher education institutions in the region have tried to boost university spinoffs and graduate entrepreneurship, mainly through incubators, but there is limited collaboration between the institutions. There

is a growing, but limited offer of entrepreneurship training to students that tends to be delivered traditionally. Provision of entrepreneurship programmes should be scaled up, focusing on growth-oriented entrepreneurship while not neglecting social and cultural entrepreneurship, and by using interactive and experiential teaching methods.

There is a need to address governance and quality assurance issues in the fragmented education system.

One of the main issues impeding human capital development in Paraná is the fragmented governance architecture and the absence of a region-wide co-ordinating structure and mechanisms to provide a long-term vision and implement an integrated development strategy for a wide range of types of educational institutions in the public and private sector, which is facing considerable quality challenges. Transparent pathways for students through the education system are necessary. This involves the development of more effective credit recognition schemes, course and programme co-ordination agreements, clear and enforceable policies related to credit transfer and increased support for joint and collaborative programmes.

The development of a quality assurance system is key to helping higher education institutions in Paraná improve their teaching, research and service functions. The current quality assurance systems focus on inputs rather than learning outcomes and institutional impact. A quality assurance system should place greater importance on graduates' performance and benefit from the information provided by employers. By doing this, higher education institutions would capitalise on input for their academic programmes as well as strengthen ties with graduates, employers and the community at large.

Despite the fact that quality assurance is part of the Federal Government's tasks, Paraná could explore the feasibility of establishing a state-wide independent quality assurance organisation or agency to which all higher education institutions in the state could be invited to participate on a voluntary basis. Such an independent agency could establish accreditation criteria competitive at the international level. At the initial stage, voluntary involvement could be supported with incentives offered to those institutions, both public and private, willing to participate. By engaging key stakeholders in the process and by linking efforts more concretely with outcomes, incentives and institutional change, higher education institutions would take more "ownership" of their own institutional quality assurance systems as a tool for improving their institutional effectiveness.

The following measures would promote human capital development in Paraná:

- The state government and higher education institutions and interested parties should work together to improve the data on labour market needs and trends. Higher education institutions should systematically monitor student progress as well as students' labour market outcomes and graduate destinations. The most effective region-wide graduate labour market systems are based on the collection of comprehensive labour market intelligence and on-line publication of the data in a single place. This improves students' ability to make rational choices about their studies, helps graduates and employers to come together and helps students to move to employment. Effective labour market systems use the data strategically to identify regional and institutional priorities and help higher education institutions respond to the data in terms of course provision and the supply of employer-specified skills.

- The state government should explore the feasibility of establishing a state-wide independent quality assurance organisation or agency to which all higher education institutions in the state could be invited to participate on a voluntary basis. Such an independent agency could establish accreditation criteria competitive at the international level. At the initial stage, voluntary involvement could be supported with incentives offered to those institutions willing to participate.

- Higher education institutions and federal and state governments should continue and expand efforts to increase the enrolment and success of students from lower socio-economic backgrounds. These efforts should build upon international best practices of effective academic, social and financial support for students, long-term collaboration with secondary education institutions to improve students' learning outcomes and raise their aspirations and adoption of more student-centred learning methods. Student aid programmes at the state level should be reviewed in order to ease financial burden of attending higher education and make loans more available to students.

- Higher education institutions should continue and strengthen their efforts to improve completion rates. The efforts of several higher education institutions in the region have shown genuine promise, and these efforts should be supported, expanded, and disseminated as models to other institutions.

- Higher education institutions should focus on the employability and entrepreneurial skills of graduates; providing students with the skills and competencies needed in the globalised knowledge economy. Stronger alignment of education provision with regional needs, closer university-

industry collaboration, work-based and problem-based learning opportunities and programmes to develop transferable and entrepreneurship skills would improve employment outcomes of students. Similarly, efforts in language learning could help the region in its internationalisation efforts. All degree programmes should also include learning English.

- The state government and higher education institutions should take steps to significantly expand higher education opportunities for working age adults. These steps should create clear and transparent pathways to advanced education for adults, including the ability to attend multiple institutions, obtain short-term education and training that can later be applied to degrees, and re-skilling and up-skilling courses and programmes designed around the particular needs and interests of adults who often combine work and study. The state government could consider establishing an agency to help recognise prior informal and non-formal learning.

- The state and federal governments and employers should recognise the increasing relevance and importance of education in technical employment fields. There is clear evidence that needs and opportunities are growing in these fields, but that these trends are under-recognised in Paraná and within higher education.

Innovation in Brazil and Paraná

Brazil has in recent years made strong progress in knowledge generation and capacity building for research and innovation. Despite the progress made, Brazil continues to have a low innovation rate and a low level of industry participation in R&D. Development in Paraná has been promising: the state has made investments in science and technology and public-private partnerships to boost industry participation in R&D, and the employers' associations have played a very active role in innovation activities. However, in contrast to many other states, Paraná has not yet passed a state law of innovation which can potentially jeopardise the good process.

Brazil has a strong focus on science, technology and innovation. It spends the most on R&D among the Latin American countries. It produces around 10 000 doctorates per year and is ranked 15th in global scientific publications and 25th in scientific citations. There are 270 business incubators and start-up companies, half of which focus on research and technology, and over 6 000 firms that have RDI investments valued at BRL 1.9 billion in 2008. The Innovation Law of 2004 established mechanisms to promote innovation and government-industry-academia collaboration. Despite the progress made, Brazil has a low innovation rate. R&D expenditure represents about 0.91% of the GDP. The new target of 1.5% of GDP within five years is a step in the right direction, and will bring funding in Brazil and in Paraná in line with other leading Latin American states. Private sector participation in RDI remains at a relatively low level (40%).

In the Brazilian context, Paraná has invested significantly in science and technology. Investments rose 48% between 2000 and 2007, increasing from 1.8% to 2.67% relative to the state public budget income. After São Paulo and Expírito Santo, in 2008 Paraná was third in the amount of state expenditure in science and technology (2.27% of the state public budget income). Paraná has introduced matched funding of 50% for federal investments in R&D. Since 2007, there has been a partnership between Paraná State and the Ministry of Science and Technology to develop a state-wide technology network as part of the Brazilian System of Technology Programme (CIBRATEC) that aims to develop state and national networks for supporting R&D activities in the private business sector.

Paraná also has an exceptionally active employer sector. The Federation of Industries of the State of Paraná (FIEP) was the first state industrial federation to respond to the national-level initiative aiming to identify potential sectors in Brazil. It has led the multi-stakeholder strategy work in Paraná, and has helped increase the knowledge base for innovation. It has funded a number of innovative university-industry projects. Public-private partnerships have been strengthened through the collaboration of FINEP (*Federação das Indústrias do Estado do Paraná* - Federation of Industries of the State of Paraná), FIEP, the SME-agency (SEBRAE-PR), Brazilian Institute of Product Quality (IBQP) and two technological institutes (LACTEC and TECPAR) to stimulate the development of innovation in SMEs in terms of management, process and products through zero interest rate funding by FINEP.

Paraná has invested significantly in science and technology over the last decade. It has been one of the few states that has developed public-private partnerships to boost industry participation in R&D. However, in contrast to many other states, Paraná has not yet passed a state innovation law, which is

currently in the state parliament. For this reason, the private sector has not been eligible to obtain public resources for R&D. The delay in the state innovation law could jeopardise positive progress as there is limited access to resources for supporting R&D activities and constraints remain for effective university-industry knowledge transfer.

Universities in Paraná have taken steps to engage in knowledge transfer activities but constraints remain ranging from limited human resources to a lack of incentives and institutional autonomy of public universities.

The large and diversified higher education sector in Paraná provides considerable potential to boost innovation. Considering that federal universities undertake the bulk of RDI in Brazil, Paraná is well-placed as its capacity has recently strengthened through the expansion of the of Federal University of Paraná (UFPR) and Federal Technical University of Paraná (UTFPR), and the establishment in 2009 of the International University of Latin America (UNILA) and the Federal University of Southern Border (UFFS).

However, the RDI capacity in the Paraná higher education sector faces many constraints. Poor second language capacity among RDI workers limits their ability to co-operate with international partners. Overall research production, albeit increasing, is low in international comparison. Also well-defined research priorities are lacking, resulting in research results that are poorly aligned with state and national objectives or needs. The narrow disciplinary orientation prevails in Paraná university's RDI initiatives, which constrains innovation. The lack of common evaluation procedures and performance indicators for research and the rigidness of university-industry contracts lead to low productivity and inefficient use of resources.

Public universities and the leading private institution in Paraná, the Pontifical Catholic University of Paraná (PUCPR), are responding in their own ways to regional needs and developing their innovation activities. Most of them have established knowledge transfer offices and leading institutions also have active incubators. For example, the PUCPR has recently created a Technopark (6 000m^2 at the initial stage but plan to expand to up to 40 000m^2). While there is limited data on the outcomes of these activities, the knowledge transfer offices lack the economies of scale or scope to optimally commercialise faculty innovations. They could consider widening the concept of knowledge transfer to long-term partnerships with industry, government and other partners in order to help support jobs, industry productivity and innovation in the region.

The relevance of universities depends on their ability to be responsive to regional and industry needs. Rigid bureaucratic control of universities hinders their autonomy and flexibility to play a more active role in innovation and regional development. Currently, the incentive structures for RDI, regional development and industry collaboration, remain limited, both at institutional and individual levels. Universities have limited scope for creating financial "headroom" to direct funds for specific innovation activities or development strategies, as 90% of the normal university budget is devoted to salary costs. Academic prestige and career progress is based on academic publications and not in third mission activities. There is a focus on scientific excellence such as the number of publications in internationally refereed journals, citations, patents and awards.

With movement towards a cultural change within universities and increasing human resources in science and technology, universities are now starting to take a more proactive role in the regional innovation system. In order to support the positive change, there is a need to broaden institutional autonomy of public universities so that they manage their own budgets and payrolls, while strengthening their accountability.

The restructuring of RDI funding mechanisms in Brazil and Paraná is important for long-term sustainability and effectiveness of the RDI system. Reform to the existing institutional funding framework and the enhancement of project-based competitive mechanisms are essential aspects of the reforms. In the long run, greater investment is needed in specialised infrastructure for universities, including labs and technological incubators.

Finally, it is worth noting that while university technology transfer models may lead to saleable intellectual property and start-ups, they often do not produce enterprises that grow in the region and contribute to regional economic development. The creation of localised supply networks is therefore critical to the process by which innovation is transferred to enterprises and the development of new innovations to transform and upgrade existing industries. A well-functioning regional knowledge transfer model is based on the ongoing relationship between the university and industry to determine which innovations may be best to adopt and market, creating an industry-university learning environment. It supports the human capital development required to adopt and apply process and product innovations and works with SMEs as well as large corporations. It measures success in terms of the sustainability and transformation of regional industry and employment growth.

The following measures would promote regional innovation in Paraná

- The federal and state governments should review the incentives for higher education institutions to facilitate a move from knowledge production to knowledge exchange and transfer, to encourage university-industry partnerships, to enhance universities' more concrete participation in innovation activities and to ensure that universities perceive job creation as one of the main goals of innovation.

- The federal and state government should improve the evaluation and assessment of funded RDI initiatives to ensure accountability of the use of publicly allocated resources. These include criteria and measures of quality and relevance to the socio-economic needs of society such as: *i)* continued relevance of the RDI programme to its original stated objectives; *ii)* programme results and the achievement of objectives; *iii)* impacts of the programme on its stakeholders; and *iv)* cost-effectiveness of the programme.

- The federal and state governments should develop the existing funding models of higher education institutions to improve their accountability, specialisation and efficiency. A performance-based funding system introducing competitive funds could provide greater incentives for industry and regional engagement of universities. The system could also include: *i*) formulae for block grant funding that includes higher weights for enrolment of students from within the region, for students from lower socio-economic and/or migrant backgrounds or for enrolments in academic programmes related to regional labour market needs; *ii*) policies governing tuition fees to provide for lower fees for students from the region and policies for financial aid to students; *iii*) eligibility for special or "categorical" funding that could be contingent on evidence of regional engagement and focus; *iv*) requirements that institutions collaborate in order to obtain funding; and *v*) special funding to provide matching of funding obtained by universities from contracts with regional employers for education and training services. The state government could consider establishing a special regional investment fund (funded from public and private resources) to provide funding for building university capacity for regional engagement and provide incentive funds to institutions and individual faculty members for regional initiatives. These could emphasise engaging faculty members and students in teaching/learning and applied research projects related to regional priorities. To ensure return on public investment and greater accountability, higher education institutions and state government should improve their follow-up and monitoring mechanisms to gauge the success of their programmes.

- The state government, in collaboration with leading higher education institutions and the business sector, should develop and implement a comprehensive, multi-year strategic planning process aimed at defining concrete goals for regional development, innovation, growth and sustainability, drawing on the multi-stakeholder strategy work conducted by key regional stakeholders. This should be conceived as a joint-venture between the public and leading private universities, business and industry. Efforts to unify the main goals for innovation in the region in the short- to medium-term should seek to identify a central focus. Innovation authorities should avoid pursuing too many goals simultaneously and/or dispersing resources. Co-operation among private sector businesses, public administration, regional/municipal development agencies and higher education institutions should be broadened. State government could also encourage stronger regional collaboration among the higher education sectors in Paraná. Collaboration between the state government and universities should be enhanced, for example, by mobilising university capacity to develop and implement regional development strategies and use university expertise for regional development.

- The state government could focus on cluster-based regional development, ensuring that research on clusters and industry-demand extends into the service sector, including clusters such as tourism. Clusters should be conceptualised as cutting across the manufacturing-service divide. For example, agribusiness clusters usually connect with tourism and manufacturing innovations incorporate service components. Technologies with cross-sector fertilisation potential should be promoted.

- The state government should implement collaborative efforts to improve the internationalisation of Paraná, its business sector and universities. It could consider funding targeted second language programmes, and providing adequate incentives for faculty to learn a second language in all higher education institutions promoting English as the second language of all RDI workers. It could consider establishing programmes to attract talent, high skills and professional technical labour (students, researchers, IT specialists, research scientists *etc*.). Policy instruments include employee tax incentives, repatriation schemes and improving the attractiveness of academic careers. To be more effective, these policies need to become an integral part of the region's international co-operation strategy. They can be coupled with initiatives to attract foreign investment.

- The state government should encourage collaboration between higher education institutions and local SMEs. Policy tools include people-based mobility schemes, such as the Knowledge Transfer Partnership in UK, which

improve the absorptive capacity of local enterprises and support the forum-like role of higher education institutions in strengthening regional engagement channels. Innovation vouchers exposing firms to innovation activities and stimulating a market for innovation is one relatively low-cost policy measure that has been implemented in a number of countries, such as the Netherlands, the UK and Ireland. These vouchers are small sums that firms receive with which to undertake simple innovative projects. At the operational level, innovation vouchers can meet specific needs and objectives. For instance, they can focus on specific sectors or technologies, or indeed business-to-business collaboration by only allowing applications from groups of firms. Different rounds of calls for applications can be organised to meet diverse goals and needs.

- Higher education institutions should engage in more proactive, systematic and institutional collaboration with local business and industry to promote socio-economic development in the region. This collaboration should focus on areas where Paraná has a real or potential comparative advantage. Institutions should improve links with the local manufacturing sector to encourage the introduction of product and process innovations. Institutions should improve their capacity to engage with local industry by developing a regional development strategy encompassing technology transfer and innovation as well as new business generation and by establishing professional knowledge transfer offices that actively reach out to local business and industry to collaborate long-term. Single entry points for industry and SMEs within a higher education institution or a group of institutions should be encouraged. Universities should collaborate with local businesses to design research programmes and activities that are better aligned with regional needs and ensure that local firms are aware of the benefits of hiring graduates. Collaborative research programmes could help improve links between higher education and business sectors.

- The state government should implement concrete collaborative efforts with private and public stakeholders in areas that strengthen social equity and environmental quality. For this purpose, the state government should develop (or adapt) a specific regional funding programme for combined and collaborative efforts conducted by both public universities in higher education, science and technology projects. Higher education institutions should engage in challenge-driven research, using the region and its diverse range of challenges as a "laboratory" to develop research and innovation. Integrating community outreach into training and challenge-driven research can generate improvements in life quality and low tech innovations.

Chapter 1.
Paraná and its higher education institutions in context

This chapter presents the State of Paraná's profile, its main economic activities and its socio-economic characteristics. The State of Paraná is one of the ten largest state economies of Brazil. Two large economic areas with differing dynamics define the region: the first is characterised by farming in the north central, west and southwest regions; the other being the urban-industrial dynamic in Metropolitan Curitiba and part of the Central Eastern region.

In the context of economic growth and reform that Brazil has enjoyed over recent years, this chapter examines the expansion of higher education institutions in the state and their role in regional development. The chapter seeks to identify the main strengths and weaknesses of the region and how the higher education system can better contribute to regional development.

1.1 Economic and historical overview

The State of Paraná has a short settlement history. During the 16th century, the beginning of Brazil's colonisation, the population was limited to the coastal area where the state's capital, Curitiba, is now located. The northern part of Paraná only became more densely populated around 1940, as a consequence of the expansion of the coffee plantations from the neighbouring State of Sao Paulo. This "coffee boom" is the underlying factor behind the growth of this part of Paraná. This lasted until the beginning of the 1970s, when increased competition in world coffee markets and the mechanisation of agriculture began the end to this 30-year period of prosperity. The industry was devastated by the so-called "black frost" that decimated the coffee plantations, causing nearly one million people to flee to adjacent states or to Curitiba. In more recent years, other crops, in particular soy-bean, have largely replaced coffee but, despite its important contribution to the state's exports, the northern part of Paraná that remains largely dominated by intensive agricultural activities, has so far not recovered its dynamism.

In parallel, industrialisation of the state capital, and to a lesser degree, that of the northern cities of Londrina and Maringa, began some 40 years ago. It began with traditional sectors such as the wood and food industries, and then turned towards the metal-mechanic sectors and, more recently, electrical equipment and electronics. The Curitiba metropolitan area today is one of the major hubs of Brazil's automotive industry, with Volvo, Renault and Audi-VW factories. A fiscal incentives policy set up by the State of Paraná, as well as the availability of a top-notch harbour infrastructure contributed to foreign direct investment to the area. The State of Paraná economy is export-oriented. Its exports (ranked 5th) alone represent close to 8% of those of Brazil in 2008, whereas its GDP corresponds to around 6.5% of national GDP. These are more or less equally divided between agricultural commodities and industrial products[1].

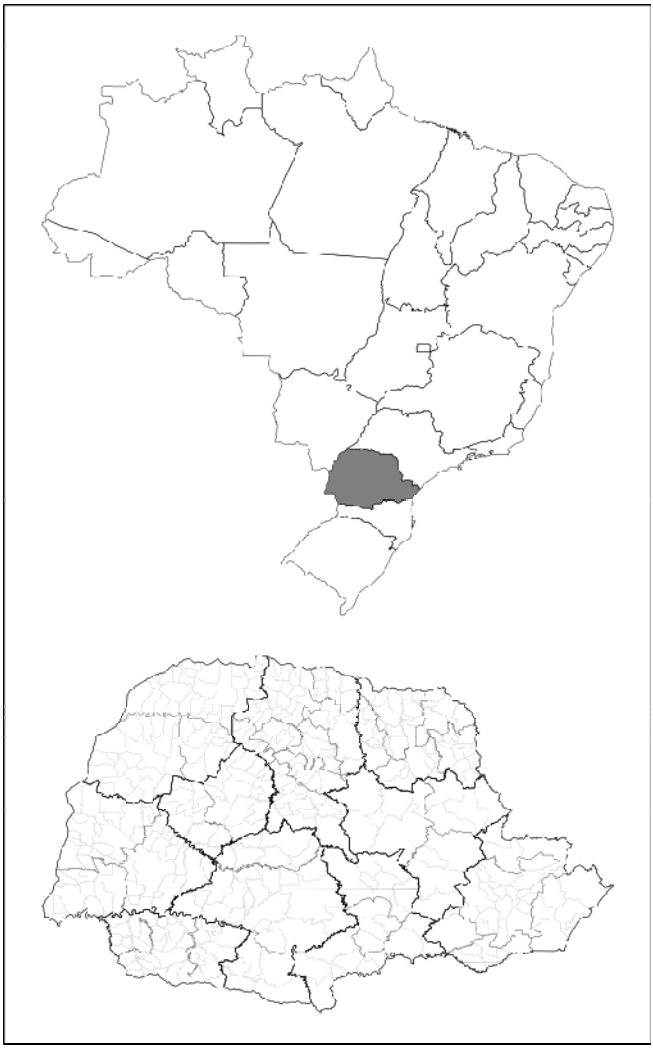
These diverging economic trends in different parts of Paraná have contributed to the emergence of two distinct activity profiles a mostly agricultural north (north central, north west and south east areas) and centre on the one hand; andon the other, the highly industrialised capital city of Curitiba, with an adjacent eastern central metropolitan area. The north of Paraná has highly productive agriculture (largest national grain producer) sector but lost jobs and population. The

central area has smaller farms and lesser mechanisation. Yet the greater Curitiba metropolitan area has become a demographic magnet as well as an industrial and service growth pole for Paraná. This capital city area today represents one third of the state's population and 45% of its GDP. A notable exception to this territorial divide is made up of the western part of Paraná, centred around Foz de Iguaçu and bordering Paraguay and Argentina. Growth in this area has been spurred on by the construction of the Itaipu dam that supplies 20% of Brazil's energy needs (and the near-totality of those of Paraguay). Research and entrepreneurial activities located within the Itaipu Technology Park (renewable energies, environmental protection in particular) as well as tourism also provide promising prospectives [2].

1.2 Geography and connectivity

With close to 200 000 km^2, Paraná represents 2.35% of Brazil's territory[3]. Situated in the south, Paraná's climate is humid tropical in the north and humid temperate in the south. Geographically it covers close to 650 km on an east-west axis (between the Atlantic Ocean and the border with Paraguay and Argentina), with a maximum distance between the north and the south of around 470 km (from the border with the State of Sao Paulo and that of Santa Catarina). There is no major topographical barrier within the State of Paraná as it comprised of a succession of plateaus averaging 1 000m, interrupted only by the narrow Serra do Mar lying east of Curitiba and culminating at 1 922m with the Pico Paraná (Manoel Luiz do Amaral; Kingraf and Scientia et Labor 1990).

Figure 1.1. Map of Brazil and Parana



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Paraná boasts a dense road network which is of better quality than that of other Brazilian states. It is the most extensive of southern Brazil (over 13 000 km) and the majority of main roads are paved. The rail network (2 288 km) connects the eastern and northern parts of the state with the port of Paraná, a major export outlet, notably for agricultural commodities from Paraná, but also from neighbouring Matto Grosso do Sul and from Paraguay. This harbour is the second in the country in terms of tonnage (33 million tonnes in 2008). Airport infrastructure and air routes are well-served. Two out of the six airports are international (Curitiba and Foz de Iguaçu) and all have regularly scheduled daily flights within the region, with four linking to other states in Brazil.

The telecommunications network in Paraná is adequate with all municipalities having fixed and mobile telephone coverage. Fibre optic networks and satellite communications are properly developed (*www.ipardes.gov.br*) ensuring internet connectivity.

1.3 Administrative organisation

Paraná is one of the 26 states of the Federation of Brazil. The State Government is headed by an elected governor, assisted by ministers. Each state has its own constitution and extensive powers, with many areas, such as education, being both federal and state competencies. Paraná comprises 399 municipalities of various sizes, many of which are small, that rely heavily on federal and state transfers: In North Central Paraná, municipalities of less than 20 000 inhabitants had only 3.80% of its own resources in 2002, while the three municipalities in the same area with over 100 000 inhabitants had around 20% of their own resources.

The municipalities sharing common geographical features and productive structures form micro-regions that are grouped for statistical purposes into "macro-regions"[4] covering the entire country. Paraná is divided into ten "macro-regions" (see Figure 1.2.)

In the current taxation structure of the Brazilian Federation the vast majority of municipalities do not have the means to invest neither in higher education nor in R&D. Resources are even insufficient for the larger municipalities and the R&D strategies tend to be in co-operation with other levels of government and/or in search of synergies with institutions.

Figure 1.2. Macro-regions in the State of Paraná

Source: Paraná's Regional Steering Committee (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, IMHE, p. 1, *www.oecd.org/dataoecd/24/53/45420606.pdf.*

Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Metropolitan Curitiba contains almost a third of the state's population, generates almost half of the state´s GDP, and provides almost half of the state's total formal employment. It is followed by the north central area and subsequently the west (Table 1.1). Population projections for the next five years confirm the trends of the last decades. Among the ten macro-regions of Paraná, Metropolitan Curitiba is practically the only region in which the percentage of the state's population has increased. With regards to contribution to state GDP figures, the picture is similar. Metropolitan Curitiba shows a growth trend while the other regions register just incremental changes. Formal employment data indicates the contrary. Although metropolitan Curitiba prevails, there has been a drop in its contribution in the medium term. This macro-region lost almost one percentage point of GDP even though it systematically increases its share in the formal employment rankings. For metropolitan Curitiba, this detrimental trend is more likely to be due to the formalisation of labour in other regions or an increase in Metropolitan Curitiba's productivity rather than a result of population moving away.

Table 1.1. Selected indicators for Paraná's macro-regions

Macro region	Population				GDP		Employment		
	Total		Percentage		% of state GDP		% of state´s formal employment		
	2008	2012	2008	2012	2002	2012	1996	2002	2008
West Central	338 751	328 376	3.2	3.0	3.06	2.54	2.4	2.2	2.2
North Central	2 003 382	2 053 404	18.9	18.8	16.35	16.47	18.5	19.5	19.4
Pioneer North	555 099	546 468	5.2	5.0	3.41	3.22	4.0	3.7	3.9
East Central	695 179	1 339 660	6.6	6.6	6.56	6.86	5.7	5.8	5.7
West	1 283 219	1 339 660	12.1	12.2	13.08	12.10	8.8	9.7	10.3
South West	584 546	588 767	5.5	5.4	4.42	4.05	4.2	3.9	4.1
South Central	472 178	476 044	4.5	4.3	3.25	2.95	2.6	2.7	2.4
South East	412 443	422 364	3.9	3.9	2.37	2.44	2.1	2.4	2.2
Metropolitan Curitiba	3 572 368	3 794 563	33.7	34.7	43.51	45.19	47.3	45.0	44.4
North West	673 004	675 714	6.4	6.2	4.01	4.18	4.4	5.1	5.5
Paraná	10 590 169	10 945 791	100	100	100	100	100	100	100

Source: Paraná's Regional Steering Committee (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, IMHE, p. 1, *www.oecd.org/dataoecd/24/53/45420606.pdf.*

Table 1.2 demonstrates that population and GDP is concentrated also at the municipal level. In 2006, the ten largest state municipalities were comprised of more than 40% of the population and generated around 58% of GDP. Just the four municipalities that make up the Curitiba metropolitan region consisted of 22% of the population and almost 40% of GDP.

Table 1.2. Principal municipalities of Paraná

Municipality	Population 2007	Distance to capital (km)	% of GDP 2006	Macro-region	% Population Growth 1996-2007
Curitiba*	1 797 408		23.5	Metropolitan	21
Londrina*	497 833	378	4.8	North Central	18
Maringá*	325 968	424	3.9	North Central	21
Foz do Iguaçu*	311 336	630	4	West	34
Ponta Grossa*	306 351	118	3.2	East Central	19
Cascavel*	285 784	491	2.4	West	60
São José dos Pinhais*	263 622	19	5.1	Metropolitan	56
Guarapuava	164 567	252	1.4	South Central	5
Paraná guá	133 559	86	3	Metropolitan	7
Araucária	111 952	28	6.2	Metropolitan	43
Paraná	10 284 503				23

Source: Paraná's Regional Steering Committee (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, IMHE, p. 7, *www.oecd.org/dataoecd/24/53/45420606.pdf.*
Note: * estimated population.

1.4 Demography and society

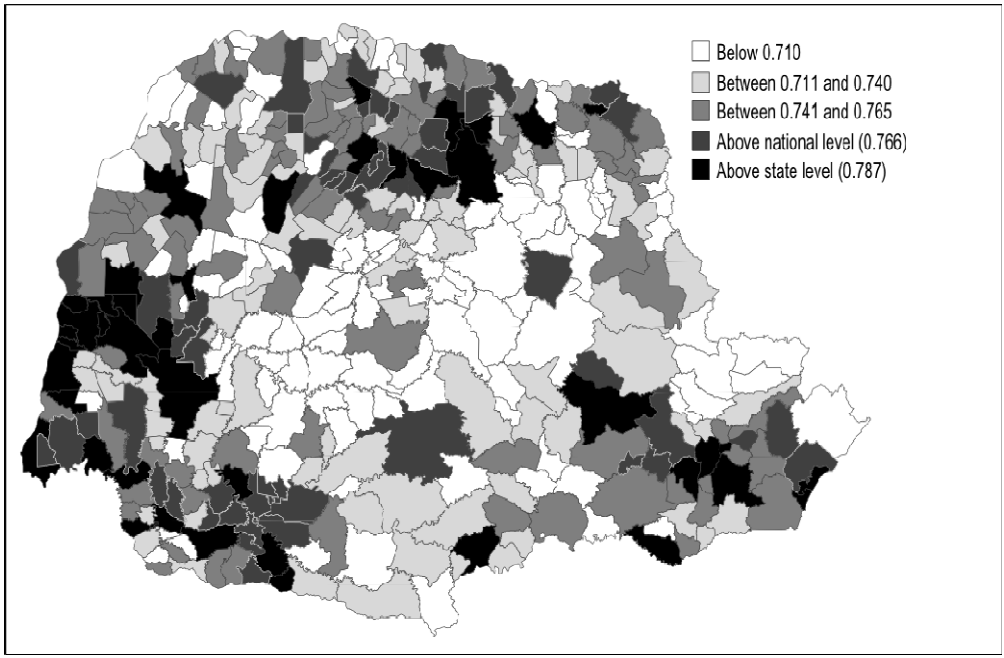
In 2008, Paraná had around 10 590 000 inhabitants of the 183 988 500 total Brazilian population (5.59% of the country's population), placing it sixth in demographic terms with regard to the Federation[5]. Paraná has a very diverse population, predominantly of European origins, mostly from Eastern Europe, but also from Germany and Portugal, as well as Japanese. Although the average population density is approximately 53.5 inhabitants per km^2, 40% of the population is concentrated in the ten major urban areas. From 1996 to 2007, these areas recorded significant population increases, reaching a record 56% in the case of Sao José dos Pinhais and 43% in Araucaria, both municipalities neighbouring Curitiba, which itself registered an increase of 21%. Foz de Iguaçu had the third highest population increase of 34% over the same period. Immigration flows towards urban areas between 1995 and 2000 were mainly towards the Curitiba metropolitan area and to a lesser degree towards the north central and western regions where other major urban areas of Paraná are located: Londrina (close to 500 000 inhabitants in 2007), Maringa (326 000) and Foz de Iguaçu (311 336).

These immigration patterns have led to a relative population decrease in all macro-regions as compared with that of Curitiba, with

stability only in the east central region adjacent to Curitiba. These flows are mainly the result of rural out-migration but also of immigration from other states. Projections for 2020 show an even greater concentration of the population in the three most urbanised areas: Curitiba, north central (Londrina and Maringa) and the west (Foz de Iguaçu, Cascavel and Toledo) which will represent together two thirds of the state's population (PRSC, 2010). Such trends represent a great challenge for state authorities. Rural development will need to revitalise ageing rural areas by encouraging job creation and organising training of human resources. One of the responses to the demographic changes such answer provided by the State of Paraná is the recent creation of the *Universidade sem Fronteiras* or "University without Borders" (see Chapter 2).

Paraná is one of eight states with a higher than average standard of living in Brazil. With BRL 15 711.20 per capita in 2007, it has the seventh highest standard of living in the country, slightly above the national average of BRL 14 464.73[6]. Within Paraná, the north central and western regions and the metropolitan area of Curitiba have the highest standards of living according to the Municipal Human Development Index (MHDI), derived from the UNDP index (see Figure 1.3.). In these three areas, with only around 25% of the population residing in municipalities below the MHDI national average, 75% of the inhabitants enjoy above average living standards. On the other end of the scale, in three other regions, around 80% of the population resides in cities below the MHDI national average and 50% in two other macro-regions (Parana's Self-evaluation Report, 2010). These considerable territorial imbalances present a challenge for future regional development strategies as they are often linked to rural decay.

Figure 1.3. Human development index map of Paraná



Source: Own elaboration with data from IPARDES (Instituto Paranaense de Desenvolvimento Econômico e Social) (2010), *www.ipardes.gov.br/imp/,* accessed 14 August 2010.

Paraná is among the richest states in the Brazilian Federation with a GDP per capita at approximately three times that of the poorest states in the northeast of the country. Poverty in Paraná has been decreasing. In 1991, 34.9% of the population lived below the poverty line dropping to 23.7% in 2000, compared with higher national averages of 40.1% and 32.7% respectively. However, Paraná has the highest poverty levels among the southern states, compared with 19.7% in Rio Grande do Sul and 16.2% in Santa Catarina in year 2000 (see Table 1.3). In terms of absolute figures, 2.2 million of Paraná's inhabitants were considered as poor. (see Figure 1.3: this map is calculated on the basis of the number of people below the poverty line retained for the application of social support programmes (one half of the minimum national wage by household).

In absolute percentages by municipality, poverty affects mostly declining rural areas having minimum accessibility, situated in the central parts of Paraná, on the coast or in the north. Although in

Curitiba less than 10% of the population was below the poverty line in 2000, in absolute numbers this represented 143 000 people, signifying a major issue in terms of urban development and welfare policies (*Atlas do Desenvolvimento Humano no Brasil* – Atlas of Human Development Index in Brazil, 1991-2000) (see Table 1.5). Progress in the fight against poverty has continued since 2000. No data was provided to establish this assumption or measure the impact of the national "*Bolsa Familia*" programme in Paraná, supporting the families on low-income, on the condition that their children stay in school[7].

Table 1.3. Incidence and intensity of poverty in the southern region's states and in Brazil, 1991 and 2000

State	Percentage of population living in poverty 1991	Percentage of population living in poverty 2000	Intensity of poverty, 1991	Intensity of poverty, 2000
Paraná	34.9	23.7	43.1	42.3
Rio Grande do Sul	28.8	19.7	42.3	41.7
Santa Catarina	27.1	16.2	42.1	40.7
Brazil	40.1	32.7	49.2	49.7

Source: *Atlas of Human Development in Brazil, 1991-2000,* United Nations, Development Programme (UNDP), Brazil, Ministry of Planning's Applied Economic Research Institute (IPEA) and the Fundação João Pinheiro (Joao Pinheiro Foundation), Governo de Minas Gerais (Government of Minas Gerais) (MG).

Table 1.4. Incidence of poverty in Paraná, 2000

Municipality	Percentage of population living in poverty, 2000	Total Population, 2000	Estimated number of people living in poverty
Adrianópolis	55.48	7 007	3 887
Cerro Azul	60.64	16 352	9 916
Doutor Ulysses	68.62	6 003	4 119
Curitiba	9.06	1 587 315	143 811

Source: PRSC (Paraná's Regional Steering Committee) (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, *www.oecd.org/dataoecd/24/53/45420606.pdf.*

The 2020 forecast of the population of 18 to 22 year olds shows just a 4% increase in relation to 2008. The results again show large differences between the macro-regions where in many there is an

absolute drop in this population group. In the North central region, the number of 171 075 young people in 2008 will drop to 163 634 in 2020, representing a 4.3% decrease. This age group will substantially increase in other macro-regions. This is the case of the West, which will have an increase of 7.9% and Metropolitan Curitiba with an increase of 16.0%.

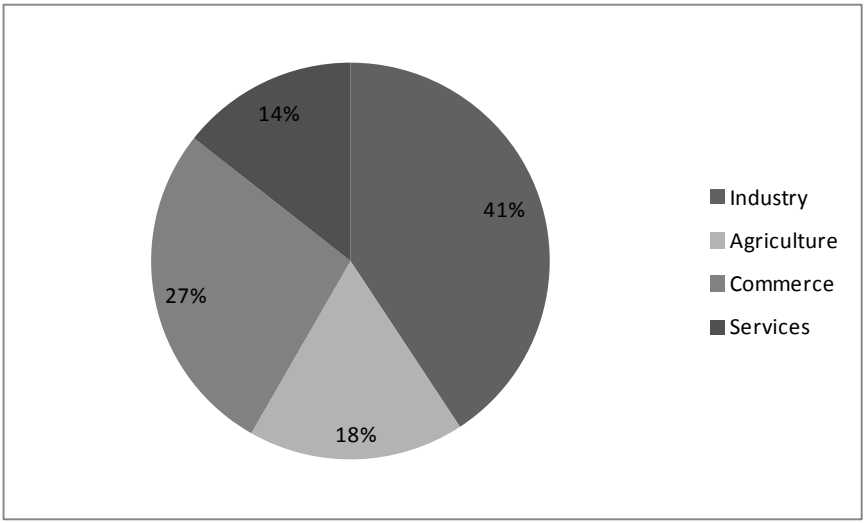
These projections indicate that in 2020, almost 40% of Paraná's population at higher education age will be living in metropolitan Curitiba. Therefore it will not be surprising if public and private investments in higher education will be concentrated there.

1.5 Regional economy

The share of Paraná in Brazilian GDP has been slightly eroding over the recent period. In 2002, Paraná GDP was 6% and reached 6.4% in 2003 while in 2008 it was only 5.8%, coming in at 22nd for growth in the country between 2002 and 2007 (IBGE, 2007a). Industry represents 40.7%, agriculture 17.6%, commerce 27.3% and services represent the remaining 14.4% (IBGE, 2007a; PRSC, 2010).

The greater Curitiba metropolitan area's contribution to the state's GDP is significant. In eight sectors[8] it represents between over a half to two thirds of gross added value. In the financial sector it is close to 90%. Agriculture, in the north central, western and south-western regions where productivity is the highest, accounts for over 50% of added value in the primary sector. The concentration of economic activity in Curitiba and adjacent municipalities is reflected in the distribution of formal employment, 45% of which is located in the corresponding region, followed by the north central region (20%) and the western region (10%).

Figure 1.4. Economic Structure of Paraná



Source: PRSC (Paraná's Regional Steering Committee) (2010), "The State of Paraná, Brazil: Self-Evaluation Report", p. 14, *OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, *www.oecd.org/dataoecd/24/53/45420606.pdf.*

Table 1.5. GDP at constant prices

GDP at constant prices			
Year	**Paraná**	**Brazil**	**Paraná's share of Brazil's GDP**
	USD million*	USD million**	(%)
2002	88 407	1 477 822	6.0
2003	96 366	1 494 795	6.4
2004	96 929	1 580 194	6.3
2005	93 834	1 630 067	5.9
2006	98 190	1 694 844	5.7
2007	104 081	1 790 903	5.8
2008	110 118	1 881 784	5.8
Annual growth rate for the period			
	3.14	**3.45**	

Source: PRSC (Paraná's Regional Steering Committee) (2010), "The State of Paraná, Brazil: Self-Evaluation Report", *OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, p. 11, *www.oecd.org/dataoecd/24/53/45420606.pdf.*

Note: *Implicit Deflator for Paraná GDP. 2002=100

Note:** Implicit Deflator for National GDP. 2002=100

The major employment sectors are light industries, public administration and retail businesses. Between 1996 and 2007, public employment dropped from around 22% to 17% whereas light industries (from around 21% to almost 25%) and retail businesses have increased. Traditional industries (food and agro-industries, wood and furniture) remain major employers but newer sectors (transportation equipment, chemistry and plastics, metal industries and electrical equipment) are creating more jobs. These trends demonstrate the growing integration of Paraná's economy into the global economy. To maintain and increase its share of Brazilian exports (now standing at 8%), Paraná must continue to improve its competitiveness.

Unemployment

Due to the international financial crisis that began in the second half of 2008[9], there has been a global economic deceleration in industrialised countries, emerging economies and developing countries. Despite its growing participation in the world economy, Brazil appears to be less affected than other countries. At the end of 2008, Paraná's average unemployment rate was 4.59%, a steady decrease since 2003 (7.16%). Unemployment rates in the greater Curitiba metropolitan area were slightly higher than average (5.61%), reflecting lack of adjustment between the massive immigration inflows into the area and job market needs.

Unemployment is linked to the number of years of study completed, with the highest rates in areas in which people have completed 8 to 10 years of school (completed primary but not secondary school). The rate then decreases as the number of completed years of education increases. This trend has been verified at state level as well as in the capital city area and in the interior. However, in Curitiba unemployment rates are below the state's average, as are those of the interior, for people having completed 15 years of study or more (2.22% instead of 3.21% for the whole of Paraná and 3.80% in other parts of the state). This indicates that unemployment rates tend to decrease over ten years of study and even more over 15. But in the latter case, the most favourable situation is observed in Curitiba where Paraná's highly qualified jobs are concentrated. (See also Annex 1.1., Table A.1.1.2.)

Most firms in Paraná, as in the rest of Brazil, are small and medium-sized enterprises, more specifically micro and small enterprises, following the definition used by SEBRAE (Brazilian Support Service for Micro and Small Businesses): Industrial micro-

enterprises have up to 19 employees and in retail and services up to 9 employees. Small industrial enterprises have between 20 and 99 employees and in retail and services between 10 and 49 employees. Medium-sized industrial enterprises have between 100 and 499 employees whereas in retail and services the number of employees is between 50 and 99 employees. Micro and small enterprises represented 98% of industry, retail and services firms in Brazil in 2004. Between 2000 and 2004, the formation of micro and small enterprise increased by 22.1% and medium- and large-size enterprises by 19.5%. Micro and small enterprises in Paraná represent 8% of the 5 028 million enterprises in Brazil. Industry (8.7%) weighs more than commerce (7.9%) or services (7.6%), reflecting the industrial base of the State. As in the rest of Brazil, 56% of these firms in Paraná are in the retail sector, 29% in the service sector (30% for Brazil) and 16% in industry (14% for the whole of Brazil) (APUD, SEBRAE-SP, 2006).

Table 1.6. Distribution of SMEs, Paraná and Brazil by activity sector, 2004

Distribution of SMEs, Paraná & Brazil, 2004				
	Commerce	Services	Industry	Total
Paraná	222 492	113 820	62 260	398 572
Brazil	2 822 753	1 488 016	717 549	5 028 318
PR/BR	7.9%	7.6%	8.7%	7.9%
Distribution of SMEs by activity sector %				
Paraná	56	29	16	100
Brazil	56	30	14	100
Minimum in Brazil	49	15	9	100
Maximum in Brazil	72	40	20	100

Source PRSC (Paraná's Regional Steering Committee) (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, p. 11, *www.oecd.org/dataoecd/24/53/45420606.pdf,* quoted from SEBRAE-SP (2006), *Ondes estão as micro e pequenas empresas no Brasil. São Paulo*, (Where to find Small and Micro Business in Brazil,) *www.biblioteca.sebrae.com.br/bds/BDS.nsf/D439A0DBD502ACFF8325743A00688EB6/$File/NT000378D2.pdf*.

In Paraná, most micro and small industrial firms are involved in construction, clothing, food and furniture (55% of industrial firms in 2004). Service firms handle lodging, catering and services to other firms (more more than 50% of service firms are in these 3 activities). Clothing, small markets, construction materials and automotive parts dominate the retail sector. Between 2000 and 2004, the service sector registered the highest growth in the number of firms (31.2%), followed by retail (25.6%) and industry (16.2%). To sum up, micro firms

represent 85% of firms registered in the State of Paraná. For the distribution of SMEs in Paraná and Brazil, see Annex 1.1., Table A.1.1.3)

In 2008, micro and small firms correspond to more than half of formal employment in Paraná (982 000 employees) while medium-sized and large firms employed around 775 000 people (SEBRAE/DIESSE, 2008) (see also Annex 1, Table A.1.1.4). These figures indicate the strategic role that micro and small firms play in Paraná's economy, emphasising that effective regional engagement of higher education institutions requires attention to entrepreneurship and training and creating demand for research, development and innovation, in partnership with organisations representing small businesses.

1.6 Higher education in Brazil

Framework

Education in Brazil is a shared responsibility between the federal government, the states and municipalities. The promulgation of the 1988 Constitution, Law 9.394/96 adopted in 1996, named after the then minister of education ("Darcy-Ribeiro Law"), indicates that the three entities organise their educational systems collaboratively. The national Ministry of Education is responsible for establishing national education policy at the federal level as well as co-ordinating between the different levels and systems as well as regulatory functions. This ensures basic homogeneity in a decentralised framework.

The national Ministry of Education is assisted by a consultative body, the National Council for Education (CNE), comprising the "basic education chamber" and the "higher education chamber" enables social partners to participate in the implementation of educational policy. Within the national framework, primary and secondary education are organised as state-co-ordinated municipal and state responsibilities. In higher education, there are municipal, state and federal institutions in each state of the federations. This system recognises the autonomy of the federation and the states in higher education as each is empowered by the above-mentioned 1996 law (Article 9) to "authorise, recognise, accredit, supervise and evaluate the courses of higher education institutions and the establishment of their educational system".

The Ministry of Science and Technology is responsible for innovation and research at the federal level. This is based on the "Law of Innovation" of December 2004 that aims, through a system of incentives, to create an environment for strategic partnerships between universities, technological institutes and firms. More specifically, the law establishes different mechanisms to increase and facilitate the transfer of knowledge generated within academic institutions towards the productive sector.

Public and private institutions

Brazil has a diverse higher education system. The private sector ensures the education of around three quarters of the national student population. Private institutions out-number public institutions, whether federal, state or municipal, by ten to one. Thus, in 2007, of the total 2 281 tertiary education institutions in the country, 2 032 were private and 249 public.

The recent development of Brazil's higher education infrastructure has widened access to higher education for many more students. This is largely due to the private sector's dynamism with the creation of new establishments in all states, often by opening new learning centres in interior towns and cities where public institutions are scant or absent (PRSC, 2010). Specialised training institutions represent 80% within the private sector and non-profit institutions (community, confessional or philant0hropic) represent around 20%.

Within the public sector, federal, state and municipal institutions constitute 42.6%, 32.9% and 24.5% respectively. A large share of federal and state higher education institutions are universities (51.9% and 42.7%) whereas municipal higher education institutions are mostly faculties, schools of applied science and technical institutes. Last, of the higher education institutions, only 183 or 8% are universities, whether public (96) or private (87) (see Table 1.8.). The Regional Self-Evaluation Report (PRSC, 2010) recognises that for a country like Brazil the number of universities is limited, considering especially that "It is precisely within universities that the best quality of teaching is ensured, as well as a sizeable share of research and post-graduate courses".

Table 1.7. Number of higher education institutions in Brazil, by administrative category – 2007

Category	All HEIs	Universities	University Centres[10]	Integrated Faculties	Fac/Schools/ Institutes	Tech Ed Centred [11]
Brazil	2 281	183	120	126	1 648	204
Public	249	96	4	4	79	66
Federal	106	55			4	47
State	82	35			28	19
Municipal	61	6	4	4	47	
Private	2 032	87	116	122	1 569	138
Specific	1 594	28	63	101	1 270	132
Com/conf/phil	438	59	53	21	299	6

Source: PRSC (Paraná's Regional Steering Committee) (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, *www.oecd.org/dataoecd/24/53/45420606.pdf,* drawn from INEP Censo da Educação Superior: Sinopse Estatística, Brasília, INEP, http://portal.inep.gov.br/superior-censosuperior-sinopse

The qualifications of the teaching staff in public and private institutions and hence the quality of the teaching is an important issue in Brazil. Whereas public institutions represent only 34.3% of higher education institutions in the country, in 2007 they employed 64.5% of professors with a doctorate degree in Brazil. Also, working conditions for professors in the public and private sectors differ. Professors in the public sector benefit from stability due to tenure and shorter working hours facilitating both research and teaching. Professors in private sector work on an hourly basis, often accumulating hours. However, in recent years the percentage of the country's private sector high qualified professors has risen to 35.5% reflecting the general increase of teaching staff since 2002. In 2007, there were 317 041 professors in teaching activities in Brazil, as compared with 227 844 in 2002. During the same period the private sector recruited 64 375 professors as compared with 24 822 for the public sector (INEP, 2009).

Secondary education and access to higher education

The higher education system cannot be analysed without exploring the features of the secondary school system and entry conditions for tertiary education, which can raise important equity issues. Brazil, alongside other Latin American countries, participates in PISA. PISA measures the science, reading or mathematics comprehension of 15 year old pupils from 75 different countries. According to the PISA 2009 results, Chile and Uruguay fare best among other Latin American

countries, with Mexico, Argentina, Colombia and Brazil lagging behind (OECD, 2010a).

PISA results show that by international standards, the performance of Brazil's secondary education system is poor. Most students attend public schools, which generally do not adequately prepare them for entry into higher education with sufficient scores in the university entrance exam, the *Vestibular*. In science, Brazil is situated at 63rd; in reading at 53rd and in mathematics at 57th. Chile, Uruguay and Mexico all score higher in science while in mathematics Uruguay, Chile, Mexico and Argentina score better and in reading, only Argentina, Panama and Peru have a lower rating.

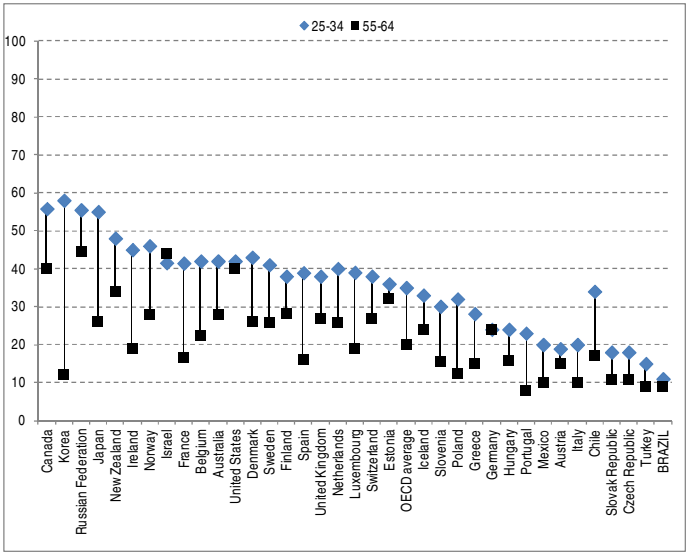
Therefore, families, who can afford to do so, send their children to private schools where the quality of teaching is far better, as corroborated by much higher success rates in the university entrance exam, the *Vestibular*. Those passing this test usually enter public universities (federal or state) where the quality of teaching is better and free. The consequence of this situation is that the majority of students attending private higher education institutions are from families in lower income brackets. Many poor families cannot afford to send their children to university unless they receive a scholarship. With some notable exceptions, the quality of teaching in private institutions is much better than that in public institutions.

Improvements are needed in education at the primary and secondary level to better prepare students. Compared with Brazil's very young population, public spending on education is low at primary and secondary education.

Higher education attainment

Despite the recent increase in the number of students, very few people between the ages of 25 and 64 have completed higher education. In 2008, only 11% of people in this age group had received tertiary education, as compared with 24% in Chile. (OECD average: 28%) (OECD, 2010b).

Figure 1.5. Population that has attained at least tertiary education, 2008



Note 1: Countries are ranked in descending order of the percentage of 25- to 34- year-olds who have reached at least tertiary education. For Chile, the reference year is 2002 and 2004 for the Russian Federation.

Note 2: For technical reasons, these figures use Israel's official statistics, which include data relating to the Golan Heights, East Jerusalem and Israeli settlements in the West Bank.

Source: OECD (2010b), *Education at a Glance*, OECD, Paris.

21 *http://dx.doi.org/10.1787/664024334566*

In the long term, Brazilian economic growth will require more trained human resources in different fields than those that the present system is able to deliver. There should be pressure for reform, both in terms of social cohesion and economic development. Greater admittance into the Brazilian higher education system will require addressing equity issues without compromising quality. At the same time, the quality of the public primary and secondary education should be improved so that admittance into tertiary education is based on individual performance within a more homogenous secondary school framework providing equal chances for all.

Funding of higher education

In 2007, Brazil's public spending on education was 5.2% of GDP and public spending on higher education was 0.8% of GDP (see also Table 1.8 and Figures 1.6 and 1.7).

Table 1.8. Public expenditure on education as a percentage of GDP, 2007

	All levels	Tertiary education
OECD Average	5.2	1.2
Chile	4.0	0.6
Mexico	4.8	0.9
Brazil	5.2	0.8

Source: OECD (2010b), *Education at a Glance: 2010*, OECD, Paris.

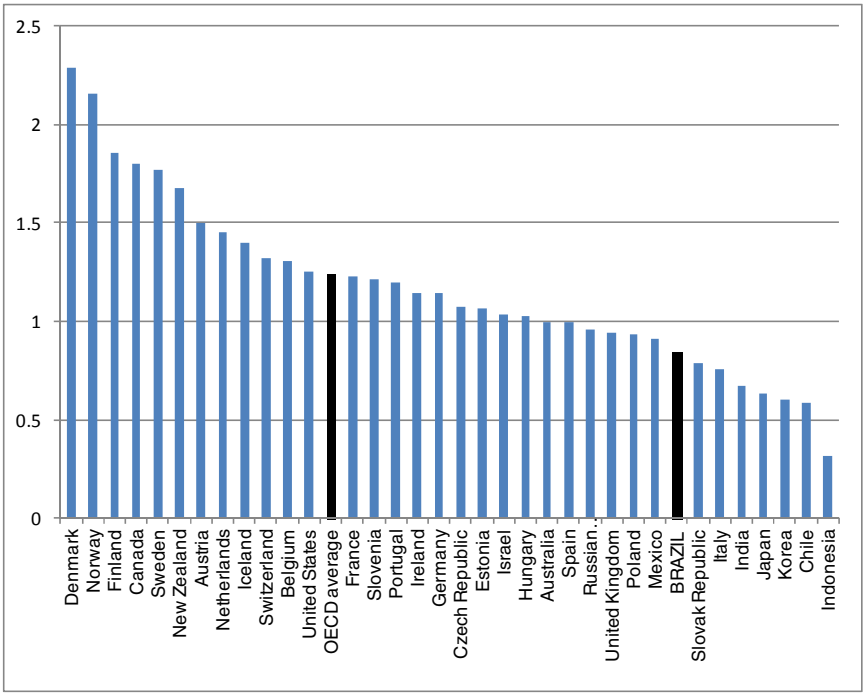
21: http://dx.doi.org/10.1787/888932310339

The federal government directly finances the operation and maintenance of federal higher education institutions. In addition, financial resources for higher education are transferred to institutions through a variety of different programmes. For postgraduate study and research, the main source of such funding is CAPES which provides fellowships for graduate programmes.

Private institutions charge tuition fees and are eligible for state support for payment of scholarships to economically disadvantaged students. All higher education institutions are allowed to undertake industry funded research and other private services.

The funding of higher education in Paraná comes from multiple sources depending on the ownership and governance of the institution. Federal, state and municipal level institutions are almost wholly financed by public funds, although state and municipal higher education institutions can access local and private funds. Out of a state budget of USD 12.4 billion in 2008, the share of higher education was 5.07%, allocated by the State Secretariat for Science, Technology and Higher Education (SETI). Another 14.2% is allocated to the Secretary of Education, which is responsible for the upper secondary education system (GEP, 2007). Within the resources allocated to higher education, 2% of the state revenues are allocated to Foundation Araucária (*Fundação Araucária*), of which around 50% is allocated for human resource development, through scholarships.

Figure 1.6. Public expenditure on tertiary education as a percentage of GDP, 2007



Note 1. Public expenditure presented in this table includes public subsidies to households for living costs (scholarships and grants to students/households and students loans), which are not spent on educational institutions.

Note 2. Countries are ranked in descending order. The year of reference for Canada is 2006, Chile is 2008 and for India is 2005. Figures for Luxembourg, Poland, Portugal, Switzerland, Brazil and the Russian Federation are direct public expenditure on educational institutions and do not include public subsidies to households.

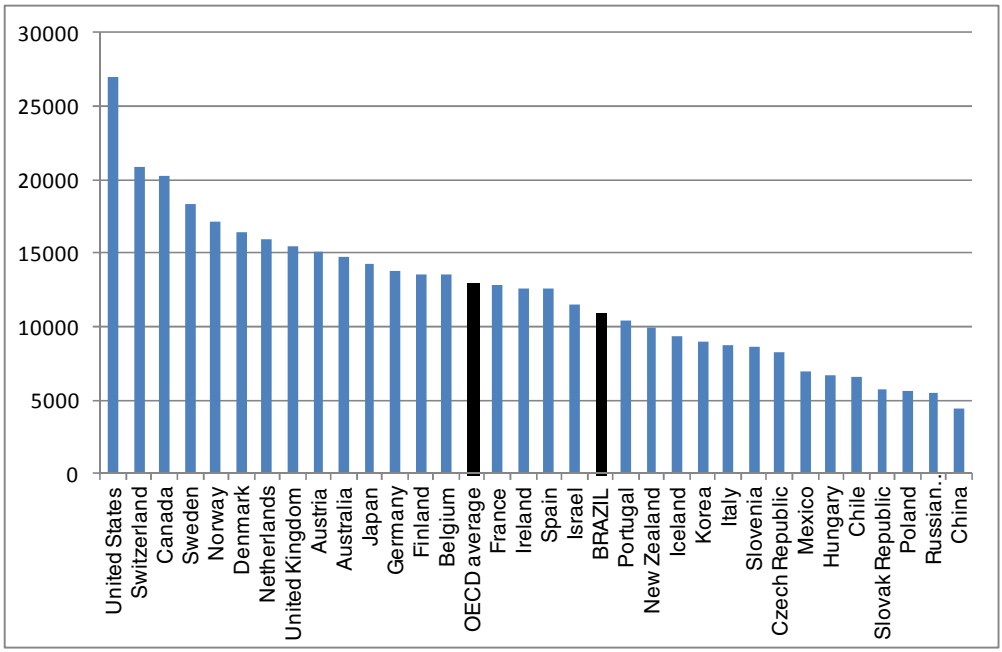
Note 3. For technical reasons, these figures use Israel's official statistics, which include data relating to the Golan Heights, East Jerusalem and Israeli settlements in the West Bank.

Source: OECD (2010b), *Education at a Glance*, OECD, Paris.

21: http://dx.doi.org/10.1787/888932310339

Figure 1.7. Annual expenditure by educational institutions in tertiary education (including R&D activities) per student for all services (2007)

In equivalent USD converted using PPPs for GDP



Note 1. Countries are ranked in descending order. The reference year for Canada is 2006 and 2008 for Chile. Figures for Canada, Hungary, Italy, Luxembourg, Poland, Portugal, Switzerland, Brazil and the Russian Federation are for public institutions only.

Note 2. For technical reasons, these figures use Israel's official statistics, which include data relating to the Golan Heights, East Jerusalem and Israeli settlements in the West Bank.

Source: OECD (2010b), *Education at a Glance*, OECD, Paris.

21: http://dx.doi.org/10.1787/888932310282

1.7 Higher education in Paraná

Framework

In the State of Paraná, the State Secretariat for Science, Technology and Higher Education (SETI) is the only administrative body in charge of higher education both for teaching and research. It is

responsible for co-ordination between public institutions, between the public and private sector, with municipalities, with other administrations when required. The "Co-ordination of Higher Education" (*Coordenadoria de Ensino Superior*, CES) is responsible for the following activities:

- Planning, supervising and evaluating the educational system in terms of means and results, reflecting in particular the guidelines set out by the "Management Council of Higher Education Institutions" (Conselho de Dirigentes de Instituiçoes de Ensino Superior, CODINES) in tertiary education, science and technology.
- Co-ordinating activities with those of the "Co-ordination of Science and Technology" (Coordenadora de Ciencia y Tecnologia, CCT).
- Approving and applying standards regulating higher education.

Alongside the CES, the "Paraná State Council for Education (*Conselho Estadual de Educaçao do Paraná*, CEE-PR) plays an advisory role, helping to define standards and rules, undertaking studies concerning the state educational system and proposing measures to improve it as well as elaborating proposed criteria to accredit new institutions.

Public and private institutions

In 2008, there were 178 higher education institutions in Paraná's state system, 22 being public and 156 private. Paraná has about half the total number of higher education institutions in the southern region of Brazil. Of the public institutions 55% are in Paraná as are 89.5% of state public higher education institutions. Since 2009, when two new federal universities were established, Paraná has ten public universities – four of which are federal and six state – and five private universities. There specialised institutions have the greatest representation with 128 in the private sector present in cities and most towns in the state.

The four federal universities are the Federal University of Paraná (UFPR), which is Brazil's oldest university, created in 1912; the Federal Technological University of Paraná (UTFPR), with university status since 2005 but created 100 years ago as a technical training school; and UNILA, the International University of Latin America (*Universidade Internacional de America Latina*) in Foz do Iguaçu and the Federal University of Southern Border (UFFS) in Laranjeiras do

Sul, the two newcomers of 2009. The Federal University of Paraná, besides the main campus located in Curitiba, has two other locations, one in Paranágua (*Universidade do Litoral*) and the other in the interior of the country (Palotina). Total enrolment of the three campuses was 5 421 in 2008-09. The Federal Technological University of Paraná is spread across 11 campuses within the state. It had 16 840 students and 1 393 professors in 2008-09, offering a wide variety of post-graduate, graduate and vocational training courses. The federal government also maintains four technical institutes in Paraná (Curitiba, Paranágua, Foz de Iguaçu and Londrina), with four more planned to open in 2010.

Table 1.9. Number of HEIs by academic organisation according to federation unit and administrative category, 2000 & 2007.

	Total	Universities	University-centres	IF	CSI	CTE
			2000			
Brazil	1 180	156	50	90	865	19
South	176	36	6	8	123	3
Public	34	13			18	3
Federal	10	6			1	3
State	17	6			11	
Municipal	7	1			6	
Private	142	23	6	8	105	
Fee-paying	83	5	2	7	69	
Com./rel./phil.	59	18	4	1	36	
Paraná	87	10	2	5	69	1
Public	23	6			16	1
Federal	2	1				1
State	16	5			11	
Municipal	5				5	
Private	64	4	2	5	53	
Fee-paying	53	3	2	5	43	
Com./rel./phil.	11	1			10	
		2007				
Brazil	2 281	183	120	126	1 648	204
South	375	42	17	12	247	57
Public	40	19	1		14	6
Federal	15	9				6
State	19	7			12	
Municipal	6	3			2	
Private	335	23	16	12	233	51
Fee-paying	249	5	5	12	179	48

Table 1.9. Number of HEIs by academic organisation according to federation unit and administrative category, 2000 & 2007 (continued)

Com./rel./phil.	86	18	11		54	3
Paraná	183	12	7	6	142	16
Public	22	7	1		14	
Federal	2	2				
State	17	5			12	
Municipal	3		1		2	
Private	161	5	6	6	128	16
Fee-paying	1 313	4	3	6	103	15
Com./rel./phil.	30	1	3		25	1

Source: PRSC (Paraná's Regional Steering Committee (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, *www.oecd.org/dataoecd/24/53/45420606.pdf.*based on data from INEP Censo da Educação Superior: Sinopse Estatística, Brasília, INEP, http://portal.inep.gov.br/superior-censosuperior-sinopse.

Note I. F – Integrated Faculties; CSI – Colleges/Schools/Institutes; CTEs – Centres of Technological Education and Commerce. Com./ Rel./ Phil. – community/religious/philanthropic.

There are six state universities in the major cities of Paraná which covers the area well: *i)* the State University of Ponta Grossa (UEPG), with an enrolment in 2008-09 of 8 018 students on five campuses; *ii)* the State University of Londrina (UEL); iii) the State University of Maringa (UEM);[12] *iv)* the State University of Western Paraná (UNIOESTE) with five campuses and an enrolment of 9 865 students; *v)* the State University of the Centre-West (UNICENTRO) with two campuses and 8 429 students; and *vi)* the State University of North Paraná (UENP) comprising five faculties in different locations.

Besides these six universities, the State of Paraná maintains three university hospitals in Londrina, Maringa and Cascavel and six autonomous faculties: *i)* the School of Music and Fine Arts of Paraná in Curitiba; *ii)* the State Faculty of Economy in Apucarana; *iii)* the State Faculty of Science and Humanities in Campo Mourao; *iv)* the State Faculty of Philosophy, Science and Humanities in Paraná guas; *v)* the State Faculty of Education, Science and Humanities of Paranávaik; and *vi)* the State Faculty of Philosophy, Science and Humanities in Uniao da Vitoria.

Amongst the five private universities, four are specialised institutions and one is confessional: the Pontifical Catholic University of Paraná (PUCPR) with its main location in Curitiba and campuses in

neighbouring Sao José dos Pinhais, Londrina, Maringa and Toledo. In 2008-09 PUC had 30 000 students and a teaching staff of 1 300. Amongst these students, 5 000 were following Masters courses and 1 500 were post-graduates. PUC also maintains a university hospital (Cajuru) employing 1 500 people in four different units. Considered one of the best university hospitals in southern Brazil it includes four clinics (dentistry, nutrition, physiotherapy, psychology). PUC also has a Technopark located on the main campus in Curitiba. It is linked to the Curitiba Technopark programme, which facilitates technology transfer between academia and firms. It boasts an incubator and some major technology firms have set up there (Siemens-Nokia in particular).

The teaching staff in Paraná increased by 40% between 2000 (14 130 lecturers) and 2007 (19 838 lecturers). In 2007, 40.5% of staff were teaching in public institutions, of which 65.7% were employed by state institutions (INEP, 2009). The majority of professors in Paraná holding a PhD were working in public institutions (77.8% in 2000 and 71.5% in 2004). This decrease is due to the significant increase in the number of professors with a PhD recruited by private institutions, reflecting policies aiming to improve the quality of teaching. State universities in Paraná employed 61.2% of professors holding a doctorate degree in 2000, increasing to 62.8% in 2007, showing a slight improvement in the qualifications of teaching staff (INEP, 2001 and 2009).

With the overall improvement in teaching staff qualifications in Paraná higher education institutions, the results of the Federal National examination of student development (ENADE) evaluation of graduate economic courses for 2006, presented in the self-evaluation report (PRSC, 2010), show an uneven distribution across institutions. Of the 18 institutions that were evaluated, seven received the lowest rating 2 (between 1 and 5), eight received an average rating of 3 and three received the highest rating of 4. The three highest ranked were the UFPR, the State University of Maringa (UEM) and the Toledo branch of the Western State University (UNIOESTE).

Trends and perspectives

The student population in Paraná is constantly increasing. In 2008, there were approximately 330 000 students (329 741) as compared with 316 496 in 2007, out of a total of 5.5 million students in the country. Around one-third of these students were enrolled in public institutions and within that, two-thirds were in state institutions. The

private sector attracts by far the highest number of students, increasing each year: there was an additional 10 028 students between 2007 and 2008, as compared with an increase of 3 217 for the public sector (see Table 1.13.).

Higher education student enrolment in Paraná has been increasing faster than the Brazilian average. Based on the ratio between the total number of people in all age segments having followed higher education studies and the number of those between 18-22 years of age, all of Brazil was rated at 17.4% and Paraná at 22.58% in 2000, according to UNDP (2003). In 2008 in Paraná, it is estimated that 34.17% of those between the ages of 18 and 22 will have followed higher education studies, but with significant intra-regional discrepancies, (Ipardes & MEC/INEP from regional self-evaluation report). The highest estimation concerns the north-central region (Londrina and Maringa) with 41.07% and the lowest the south-east with 21.95% Recent policy initiatives aim to correct these imbalances (see below).

Table 1.10. Number of students in Paraná, 2007 and 2008

Year	2008	2007
Paraná	329 741	316 496
Public institutions	111 498	108 281
Federal institutions	33 470	33 209
State institutions	74 970	71 871
Municipal institutions	3 058	3 201
Private institutions	218 243	208 215
Specific institutions	172 353	164 644
Community /confessional/philanthropic	45 890	43 571

Source: PRSC (Paraná's Regional Steering Committee (2010), "The State of Paraná, Brazil: Self-Evaluation Report", OECD Reviews of Higher Education in Regional and City Development, OECD, Paris, www.oecd.org/dataoecd/24/53/45420606.pdf.

1.8. Regional development perspectives

In a country with a federal structure such as Brazil, regional development is each state's responsibility, with the federal government primarily intervening only when major projects have a national scope and require financial support that is out of scale as compared with the usual level of state intervention.[13] One case in point is the Itaipu dam,

a major project with an international dimension that entailed massive construction work over a period of about ten years and is strategic for the energy supply in Brazil. Although the national government also intervenes directly in other important regional projects, such as the creation of new federal universities, it is the state government that is primarily in charge of regional development.

In Paraná, the State Secretariat for Planning oversees regional development but its role appears confined mostly to co-ordinate with the municipalities and the private sector and co-financing of projects, in the absence of a regional development strategy defined and implemented with these partners.

In such a context, other local governments and the private sector play a pro-active role in defining and contributing to the implementation of regional and local development strategies. Each state municipality has a bureau or an agency in charge of regional development. It has devised an economic and social development strategy for the area. For this reason it maintains regular links with local representatives of the private sector, higher education institutions and civil society. Two of these actors play a leading role: *Agencia Curitiba*, the development agency of the capital city area and FIEP (*Federaçao das Industrias do Estado do Paraná* – Federation of Industries of the State of Paraná).

Agencia Curitiba assumes, up to a certain degree, the role of a regional development agency by defining metropolitan area strategies that link with wider state perspectives and by sharing its know-how with other municipal agencies through specific study contracts. The agency is new, created in December 2007 at the initiative of the Municipality of Curitiba, which holds 98% of this company jointly with FIEP and other related professional organisations in Paraná. With 60 employees, *Agencia Curitiba* has an operational budget of BRL 7 million (EUR 3 million), of which BRL 6.4 million (EUR 2.8 million) is allocated by the municipality. It deploys its activity through programmes and projects in two main areas: local economic development and investment promotion. The first area includes an entrepreneurship training programme and an incubator infrastructure as well as a design unit. The second comprises in particular the technology park, the *Curitiba Tecnoparque*, a "competitiveness unit" playing an advisory role towards firms and a Municipal Fund for Sustainable Economic Development supporting projects that clearly integrate environmental requirements.

Federation of Industries of the State of Paraná (FIEP) is a powerful regional professional organisation that belongs to the National Confederation of Industries (CNI). It is linked to national level federations by sector as its counterparts in other states. It represents more than 35 000 industries established in Paraná. With offices all over the state, FIEP employs 2 400 people within the different organisations that form part of the "FIEP system" (see Box 1.1) and has a budget of BRL 200 million for 2010.

Box 1.1. Federation of industries of the State of Paraná (FIEP)

FIEP is organised into the commonly known "FIEP system" comprising different organisations that cover the whole spectrum of entrepreneurial activity in Paraná. It is present in different areas of the state. FIEP, whose objective is to defend the industry's interests in Paraná, is an umbrella organisation to the following entities:

SESI (Social Service of Industry) aims to improve the quality of life of workers, their families and the local community. With a health and social staff of 1 500, SESI, it has on average 600 000 medical consultations per year and organises 155 000 inscriptions in various educational programmes.

SENAI (National Service of Industrial Apprenticeship) engages in training activities for workers: the enrolment of 150 000 students in professional education courses is targeted for 2010.

IEL (*Instituto Euvaldo Lodi*) seeks to improve industrial management, facilitating interaction between the productive sector and knowledge centres and undertaking consulting activities focusing in particular on innovation management. Around 12 000 students per year benefit from training provided by the institute.

UNINDUS (University of Industry) has the mission of training industry leaders and improving the knowledge level of management teams by integrating strategic views.

Source : SISTEMA FIEP, 2009, *www.fiepr.org.br/*

FIEP was the first state industrial federation to respond to a CNI initiative to identify potential growth sectors in Brazil. After internal consultations and linking up with local governments and social partners, it produced a strategic report in 2005 entitled *Sectors carrying future prospects for the State of Paraná,* which constitutes a road map for regional development in Paraná until 2015. On the basis

of the report, detailed sector reports were published under the heading *Strategic Routes for the Future of Industry in Paraná*, suggesting different measures to develop the areas where potential was identified. The industrial sectors considered strategic for the future are:

- biotechnology applied to agriculture, poultry and forestry (genomics, genetic improvement of cultivated species, in vitro cultivation techniques);
- food industry (functional foods, prepared products, conservation and packing technologies);
- energy (bio-fuels, energy efficiency in construction).

These widely defined sectors within the State of Paraná aim for sustainable development. They are detailed for each of the four macro-regions in which the major urban agglomerations are located. In certain cases, specific sub-regional capacities or assets are also being highlighted: For example, micro-technologies and design in Curitiba, paper and metal-mechanic industries in the eastern central meso-region, bio-technology applied to health in the north central region (where two of the three state university hospitals are located), and tourism in the case of the western region. See Annex 1.2, Table A.1.2.1 which shows the results for the four macro-regions containing the state's urban agglomerations.

There is some consensus between local governments and the private sector on the strategic analyses contained in this report. It is suggested that development programmes and measures within the state integrate its findings, but there is no state strategy to systematically carry forward this agenda.

1.9. Role of HEIs in regional development in Paraná

There is no specific "third task" for federal or state universities in Brazil. It is left to the initiative of individual universities. An implicit regional development mission is usually recognised by most institutions, that consider that they are well inserted into the local environment and attuned to most local development needs. This clear indication emerges from a survey of major higher education institutions conducted by the regional co-ordinating team for the OECD review in 2009.

The well-developed territorial coverage of higher education institutions in Paraná, mostly state and private institutions with

presence in all cities and in many towns, has a direct and indirect impact on local economic development. Besides education and training opportunities that are offered to inhabitants in different areas including those areas experiencing an economic downturn, higher education institutions provide jobs for small and medium-sized enterprises (supply chains) and are becoming more and more engaged in research and development activities linked to the local economy.

However, the major issue is how regional engagement of higher education institutions in Paraná can be pursued as a policy objective to mobilise government, higher education institutions and the private sector on the basis of clearly defined goals and methods. A certain number of measures could be taken within a broad framework that would permit benchmarking of results in different fields.

The incentive structures for higher education institutions' regional engagement are inadequate at the institutional and individual levels. Regional development achievements do not formally count among the criteria considered when renewing the yearly financial contracts of state universities nor are these elements part of the federal universities' management system. These aspects are part of the discussion but there is no formal evaluation of effectiveness of regional engagement based on objective criteria, such as the number of courses with direct regional development content or the number of research projects with impact on the local economy. Activities of this type are usually left to the initiative of departments or professors[14] and there is no incentive or reward to encourage regional development-oriented studies or research. More generally, the traditional pursuit of international excellence, both at the level of the institution and for individual careers is incentivised and preferred to activities with direct regional relevance.

There are no state innovation laws or state guidelines governing university research. In December 2004, a Law of Innovation at the federal level created incentives for innovation as well as scientific and technological research within the productive sector, while establishing measures to facilitate the transfer of knowledge from academia towards firms, in particular by stimulating strategic partnerships. The implementation of this federal framework supposes that each state parliament vote a parallel law setting out ways in which the state may support the federal effort through its own measures and resources. Currently, Paraná has not yet passed the innovation law, so the stimulus for increased co-operation between firms and higher education institutions does not yet exist, while higher education

institutions pursue their own research agenda independent of regional development needs.

Lacking a state innovation strategy, pragmatic adjustment has led to cutting-edge research with participation of higher education institutions resulting in direct economic benefits. Such forward looking activity is facilitated by the quality of the innovation infrastructure in Paraná, which boasts, besides university laboratories and technology parks in different areas of the state, high-level public research institutes such as TECPAR. TECPAR, originally created in 1940 as an agricultural research unit, is today a national reference centre contracting with higher education institutions and the private sector not only in Paraná, but also in other parts of the country.[15] It comprises in particular a Biology and Technological Research Institute, a vaccine and antigen production unit, a fine chemistry laboratory, a *vivarium* and a bio factory. TECPAR engages in metrology, product testing, certification and quality control activities in many fields, while playing a leading role in major research projects in Paraná.

Future perspectives

Higher education institutions in Paraná are increasingly aware of the opportunities for expansion that exist by participation in major initiatives with direct impact on regional development. The establishment of *Forum Futuro Paraná 10* and the creation of new universities, recently decided by the state – "University without Borders" USF) – or by federal authorities – International University of Latin America (UNILA) and Federal University of the Southern Border (UFFS) are all projects calling for co-operation with existing entities. These initiatives and a recent publication concerning universities and regional development, analysing the case of Paraná, create a favourable context for future strategies and measures that would aim to organise and increase the contribution of the dense network of higher education institutions to the region's economic growth, social cohesion and innovation (see PRSC, 2010).

The Federal University of Parana (UFPR) participates directly in the process of the *Forum Futuro Parana 10*, which aims to elaborate a development strategy for the whole region that will be submitted to the state government. The elaboration of the strategy for ten years was based upon a series of workshops in the different macro-regions. A participative and comprehensive strategic planning process was implemented, with priorities identified by over 5 000 participants,

including higher education institutions participated. At the end of this process, eight strategic guidelines, with specific targets in each case, were adopted in December 2009. The study identified the key sectors for the future development of the state and the necessary conditions for their success, including knowledge and labour needs. Three of the leading universities in the state mentioned this study as a necessary element of their own planning process (UFPR, UFTPR, and PUC). A synthesis of these is presented below:

Box 1.2. Eight strategic guidelines for Paraná

Recreating conditions for economic dynamism

- By economic densification of depressed areas through development of bio-fuels and environmental industries and support to agro-forestry and agro-industry entrepreneurship on the basis of clusters (local productive systems or APLs).
- By strengthening of innovation capacity and multiplication of APLs.

Dynamic management of territory and land use (focus on the Curitiba metropolitan area and transport)

- By restoration of the regional centre's dynamism by creation of development poles.
- By viability of small towns by inter-municipal consortia and attention to entrepreneurship.

Strengthening of infrastructure, by:

- By road and rail integration with the harbour areas, including the creation of a third port.
- By lifting railroad and road bottlenecks
- By expansion of hydro-electric capacity, with contribution of private investment.

Box 1.2. Eight strategic guidelines for Paraná (continued)

Human capital development.

- By increasing technology management and innovative capacity, with the creation of a network of technology training centres and distance learning.
- By stimulation of entrepreneurship to leverage endogenous development.

Addressing urban environmental issues

By integration of urban, environmental and water resource management.

By micro-regional waste management programmes

Addressing rural and coastal environmental issues

By dissemination of good practices for soil and water conservation.

By improved control of land use in coastal areas and zoning of areas with ecological interest.

Improving the legal-institutional environmental framework

- By better integration of environmental concerns into Municipal Master Plans.
- By increased delegation of environmental responsibility towards municipalities.
- By strengthening institutional capacity.
- By promotion of Public-Private Partnerships (PPPs) for investment.
- By reinstatement of (public) planning strategies and prospective on the longer run.

Source: PRSC (Paraná's Regional Steering Committee (2010), "The State of Paraná, Brazil: Self-Evaluation Report", OECD Reviews of Higher Education in Regional and City Development, OECD, Paris, www.oecd.org/dataoecd/24/53/45420606.pdf.

These strategic guidelines inspired by the private sector and with the contribution of Federal University of Paraná (UFPR), the major higher education institution in Paraná and the support of the state office of SEBRAE (Brazilian Support Service for Micro and Small Enterprises) call for greater involvement of government (state and local) in regional development and partnerships between public and private actors. It is premature to evaluate the impact of an initiative.

The participation of academia in a strategy process that aims to strengthen regional development in Paraná is a welcome development. This recognition is an important first step in the connection between the university system and the future needs of the state development in terms of knowledge and labour force qualification. The movement is strong, involving all important social agents in the state apart from the state government administration. The existence of such long-term strategic view for the state will help universities adjusting their course contents to meet the expected needs.

Notes

1. Data from Ipardes for 2008 indicate that the industrial sector represents 49% of these exports and the primary sector 51% including wood and also wood industries.
2. The spectacular waterfalls of Foz de Iguaçu astride the border with Argentina, a UNESCO World Heritage site, are a major asset for the area, which is the second tourism destination behind Rio de Janeiro.
3. The land surface of Parana is exactly of 199 554 km^2.
4. Macro-region is defined by: "The social process, as determinant, the natural environment as a condition and the communication network between settlements as an element of spatial articulation. The three dimensions contribute towards the identity of the meso-region (IBGE, 1990).
5. Neighbouring Sao Paulo has the most important population in Brazil (39 827 690 inhabitants in 2007). Source: IBGE, Regional Accounts of Brazil, ibge.gov.br.
6. The highest GDP per capita is registered in the Federal District (BRL 40 696.08) and in Sao Paulo (BRL 22 667.25), according to IBGE, Regional Accounts of Brazil, for 2007.
7. There were 461 392 families in Parana benefiting from this programme in 2009.

8. Extractive industries, light industry, construction, hotels and restaurants, real estate, transport and communications, health and social services, other services (source: SEFA-PR).

9. According to the OECD Economic Survey of Brazil for 2009 this can be explained essentially by "the continued consolidation of macro-economic adjustment following the floating of the Real in 1999 - based on a policy framework combining inflation targeting, a floating exchange rate, rules-based fiscal policy making and prudent public debt-management. This policy framework…has reduced external vulnerabilities" (Page 9).

10. A University Centre is a public or private teaching institution that is not obliged to carry out research

11. A Technology Education Centre is a specialised public or private professional education institution offering regular courses and training that can also be engaged in research activities.

12. State University of Londrina (UEL) and State University of Maringa, UEM represent together around 50% of total enrolment of state universities in Parana (Northern Parana Review of Higher Education Institutions and Regional Development, OECD, 2006)

13. Within the context of fiscal policy (reform of the VAT collected by the states which determine rates), the government aims to strengthen regional policy by establishing a regional development fund. "Existing mechanisms…focus on the poorer states and fail to address the needs of the poorer areas of the more prosperous parts of the country" (OECD Economic survey of Brazil, 2009). Such a reform is of direct interest to Parana, now specifically addressing the educational needs of its lagging areas with the USF project.

14. One of the institutions that participated in the review process, PUCPR pursues as part of its compulsory curriculum community engagement activities by students in poor areas.

15. Annual budget: BRL 80 000 000; Staff: 530 employees.

Annex 1.1. Economy of Paraná

Table A.1.1.1. Average transfers by main origin of resources and size of municipalities of the North Central macro-region, 2002

Origin of resources	AVERAGE TRANSFER (BRL)					
	Up to 20 000 inhabitants		Between 20 000 and 100 000 inhabitants		Over 100 000 inhabitants	
	(64 municipalities)		(12 municipalities)		(3 municipalities)	
ICMS (VAT)	2 251 912	39.10%	4 484 563	29.20%	30 485 232	27.10%
Municipality Participation Fund	2 568 542	44.60%	7 449 591	48.40%	47 039 834	41.70%
Other transfers	942 840	16.40%	3 446 765	22.40%	35 146 949	31.20%
Own resources	221 665	3.80%	1 888 885	12.30%	23 249 781	20.60%
Compensation for exporting and road tax	151 214	2.60%	1 055 474	6.90%	11 469 100	10.20%
Water sources and conservation units	133 908	2.30%	456 927	3.00%	428 068	0.40%
Royalties from Itaipu Electric Plant	57 699	1.00%	17 111	0.10%		
Financial compensation for water resources	378 354	6.60%	28 368	0.20%		
Total*	5 763 294	100%	15 380 919	100%	112 672 015	100%

Source: IPARDES Instituto Paranaense de Desenvolvimento Econômico e Social Parana Institute for Economic and Social Development (2004), Basic data (Regional level) *www.ipardes.gov.br*, in PRSC (Paraná's Regional Steering Committee (2010), "The State of Paraná, Brazil: Self-Evaluation Report", OECD Reviews of Higher Education in Regional and City Development, OECD, Paris, www.oecd.org/dataoecd/24/53/45420606.pdf.

Table A.1.1.2. Unemployment rate - Paraná, Metropolitan region of Curitiba, countryside - 2000-08

Unemployment rate – Paraná, Metropolitan Region of Curitiba, Countryside, 2002-08							
Groups of years of study	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Paraná							
No schooling / less than one year	3.93	5.31	3.71	4.42	4.39	2.80	2.74
1-3	5.08	5.20	4.23	5.31	4.56	3.25	1.95
4-7	6.41	6.85	5.44	6.30	6.13	5.11	4.02
8-10	10.77	10.76	9.75	11.23	9.51	8.54	7.12
11-14	7.07	7.05	6.65	6.47	7.18	6.06	4.77
15 and over	4.51	3.28	2.56	2.36	2.84	3.64	3.21
Not specified	8.11	8.70	12.50	9.09	12.50	9.09	8.33
Total	**6.95**	**7.16**	**6.15**	**6.71**	**6.53**	**5.61**	**4.59**
Metropolitan Region of Curitiba - RMC							
No schooling / less than one year	4.69	9.43	5.00	1.82	4.17	4.76	6.25
1-3	7.46	6.67	5.65	7.20	4.39	3.79	3.88
4-7	8.75	7.71	7.32	8.13	7.12	6.63	5.32
8-10	13.93	12.43	12.83	15.63	11.17	9.21	8.15
11-14	7.83	10.12	7.65	8.23	8.14	7.10	5.92
15 and over	6.00	5.63	3.41	2.93	2.80	2.88	2.22
Not specified		15.38	22.22	22.22	20.00	22.22	0.00
Total	**9.12**	**9.33**	**8.07**	**8.83**	**7.55**	**6.53**	**5.61**
Paraná's Countryside							
No schooling / less than one year	3.77	4.59	3.47	4.93	4.43	2.32	2.14
1-3	4.47	4.79	3.83	4.79	4.61	3.07	1.40
4-7	5.66	6.58	4.87	5.70	5.78	4.53	3.54
8-10	9.26	10.01	8.23	9.13	8.70	8.19	6.67
11-14	6.62	5.48	6.05	5.38	6.64	5.47	4.14
15 and over	3.52	1.69	1.90	1.98	2.87	4.14	3.80
Not specified	-7.14	6.06	9.68	4.17	10.53	0.00	11.76
Total	**6.05**	**6.30**	**5.32**	**5.78**	**6.09**	**5.18**	**4.13**

Source: PRSC (Paraná's Regional Steering Committee) (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, *www.oecd.org/dataoecd/24/53/45420606.pdf.*

Table A.1.1.3. Distribution of SMEs in Paraná's commerce, by activity segments in 2000 and 2004

Segments by activity	2000 SMEs	%	2004 SMEs	%	Variation 2004/2002 (%)
Clothes retailing	19 699	11.1	24 358	10.9	23.7
Minimarkets and convenience stores	21 129	11.9	22 548	10.1	6.7
Construction materials retailing	10 181	5.7	13 776	6.2	35.3
Auto parts business	7 167	4.0	10 326	4.6	44.1
Drink distributor	8 310	4.7	10 068	4.5	21.2
Pharmacies and perfumeries	6 875	3.9	9 374	4.2	36.3
Maintenance and repair of vehicles	7 966	4.5	9 182	4.1	15.3
Office and computer equipment retailing	3 696	2.1	6 594	3	78.4
Furniture and lighting retail	4 554	2.6	6 456	2.9	41.8
Small food markets/ fruit stores	4 636	2.5	6 331	2.8	45.1
Other classes	83 239	47.0	103 479	46.5	24.3
Total	117 179	100.0	222 492	100.0	25.6

Source: RAIS, Small business watch/Sebrae-SP in PRSC (Paraná's Regional Steering Committee) (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, *www.oecd.org/dataoecd/24/53/45420606.pdf.*

Table A.1.1.4. Paraná's number of companies and employees according to activity sector, 2008

	Number of companies					Number of Staff				
	Micro	**Small**	**Medium**	**Large**	**Total**	**Micro**	**Small**	**Medium**	**Large**	**Total**
Commerce	69 655	9 066	m	m	m	199 773	161 109	m	m	m
Services	54 328	8 574	m	m	m	151 332	168 056	m	m	m
Industry	20 461	3 579	m	m	m	109 723	146 788	m	m	m
Construction	4 954	556	m	m	m	21 725	22 678	m	m	m
Total	**149 398**	**21 775**	**2 245**	**1 252**	**174 680**	**482 553**	**498 631**	**257 246**	**571 943**	**1 756 373**
										%
	Micro	**Small**	**Medium**	**Large**	**Total**	**Micro**	**Small**	**Medium**	**Large**	**Total**
Commerce	46.6	41.6	m	m	m	41.4	32.3	m	m	m
Services	36.4	39.4	m	m	m	31.4	33.7	m	m	m
Industry	13.7	16.4.	m	m	m	22.7	29.4	m	m	m
Construction	3.3	2.6	m	m	m	4.5	4.5	m	m	m
Total	100.0	100.0	m	m	m	100.0	100.0	m	m	m
Distribution by SMEs (%)										
	Micro	**Small**	**Medium**	**Large**	**Total**	**Micro**	**Small**	**Medium**	**Large**	**Total**
	85.5	12.5	1.3	0.7	100	27.5	28.4	14.6	29.5	100

Source: SEBRAE/DIEESE (2008), Anuário do Trabalho na Micro e Pequena Empresa, *www.dieese.org.br/anu/anuarioSebrae.pdf,* in PRSC (Paraná's Regional Steering Committee) (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, *www.oecd.org/dataoecd/24/53/45420606.pdf.*

Note: m = data not available

Annex 1.2. Sectors and technological areas

Table A.1.2.1 Sectors and technological areas of the future of the four macro-regions

Sectors and technological areas of the future for the Curitiba metropolitan region	
Sector	**Technological area**
Micro technology	Applied Biomedicine
	Food security
	Genomics
Biotechnology applied to the agricultural and forestry sectors	Genetic improvement to cultivated species
	In vitro cultivation techniques
Energy	Biofuels
Health	Biotechnology applied to health
	Biomaterials
Design and production technologies	Design technologies for the consumer sectors (fast and virtual prototype, segmentation of software from 2D to 3D)
	Sustainable development (mechanical metal & plastic)
	Mass production (mechanical metal & plastic)
Food industry	Functional foods
	Processed products/conservation and packaging Technology
Sectors and technological areas of the future for the East Central region	
Sector	**Technological area**
Paper	Sustainable development
	Automation
	Application of biotechnology
Farming and food industry	Functional foods
Biotechnology applied to the agricultural & forestry sectors	Genetic improvement to cultivated species
	In vitro cultivation techniques
Mechanical metal and plastic	Innovative products and processes
	Sustainable development
Consumer products	Production technologies
Tourism	Attention to security and the environment
Sectors and technological areas of the future for the North Central region	
Sector	Technological area
Biotechnology applied to the agricultural & forestry sectors	Genetic improvements to cultivated species
	Genomics
	In vitro cultivation techniques
Energy	Biofuels
Consumer products	Design technologies for the consumer sectors (fast &virtual prototype, segmentation of software from 2D to 3D)
	Production technologies
Farming and food industry	Processed products/conservation & packaging technology
	Functional products
Health	Biotechnology applied to health

Table A.1.2.1 Sectors and technological areas of the future of the four macro-regions (continued)

Sectors and technological areas of the future for the Western region	
Sector	Technological area
Farming and food industry	Processed products/conservation & packaging technology
Biotechnology applied to agriculture & forestry	Genetic improvement to cultivated species
Tourism	Product differentiation and market segmentation
	Flexible, client oriented processes
	Electronic transaction channels (e-commerce)
	Attention to security and the environment
Energy	Magnetic efficiency in constructions

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Source: PRSC (Paraná's Regional Steering Committee) (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, *www.oecd.org/dataoecd/24/53/45420606.pdf.* References

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PNADS *Pesquisa Nacional por Amostras de Domicílios* (National Survey of Household Sampling) *Instituto Brasileiro de Geografia e Estatística* (Brazilian Institute of Geography and Statistics) (IBGE)

PRSC (Paraná's Regional Steering Committee (2010), "The State of Paraná, Brazil: Self-Evaluation Report"*, OECD Reviews of Higher Education in Regional and City Development*, OECD, Paris, *www.oecd.org/dataoecd/24/53/45420606.pdf*

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Chapter 2.
Human capital development and labour market in Paraná

This chapter examines how effectively universities in Paraná contribute to meeting the social and economic needs of the population in terms of opportunities to study and relevance of the skills and competencies offered. It identifies the main strengths and areas for improvement of the regional higher education system. The chapter closes with a series of recommendations on how to improve the effectiveness of the higher education system in order to increase the role of the Paraná's universities in regional development.

While significant progress has been made in recent years in higher education, there remain concerns for equity, quality and relevance of education. Greater efforts are needed to ensure that all capable students have access to quality education and that the first generation students complete their studies and learn the skills and competencies required in the knowledge-based economy. The higher education institutions in Paraná should also strengthen the relevance of education and improve the learning outcomes and entrepreneurial attitudes among their students. They should focus on improving the quality and relevance of their educational programmes so that they are better aligned with the regional needs. Efforts are also needed in lifelong learning activities, re-skilling and up-skilling the adult population. Finally, current efforts to capitalise on the benefits of the MERCOSUL (Southern Common Market, Mercado Comun do Sul) agreement to build a higher education hub are commendable and should be scaled up.

Introduction

Universities and other higher education institutions can contribute to the human capital development in their regions basically in four different ways by:

- Widening access to and success in higher education of the existing youth and adult population of the region.
- Attracting talent to the region, including students and highly qualified faculty and researchers.
- Producing graduates with knowledge/skills relevant to the region's economy.
- Contributing to developing an economy that will employ graduates and retain and attract educated population.

Human capital is critical to regional development also because individuals with higher level skills are more productive. Furthermore, individual workers are more productive in regions where their peers have high levels of educational attainment. In this context, this chapter examines the following three dimensions to assess the effectiveness and coherence of human capital development policies in Paraná:

- Do the existing higher education providers offer adequate learning and training opportunities to the local population in terms of age, gender, and socio-economic and ethnic backgrounds?
- Are existing universities and programmes adequately aligned with the skill needs of the local economy and do they support entrepreneurship in the region? Is full advantage taken of the Bologna process to improve learning outcomes and employability?
- Is higher education in Paraná co-ordinated and governed in an appropriate way for the needs of the region?
- What lessons can be learned from international experience?

2.1 Size and evolution of the higher education sector

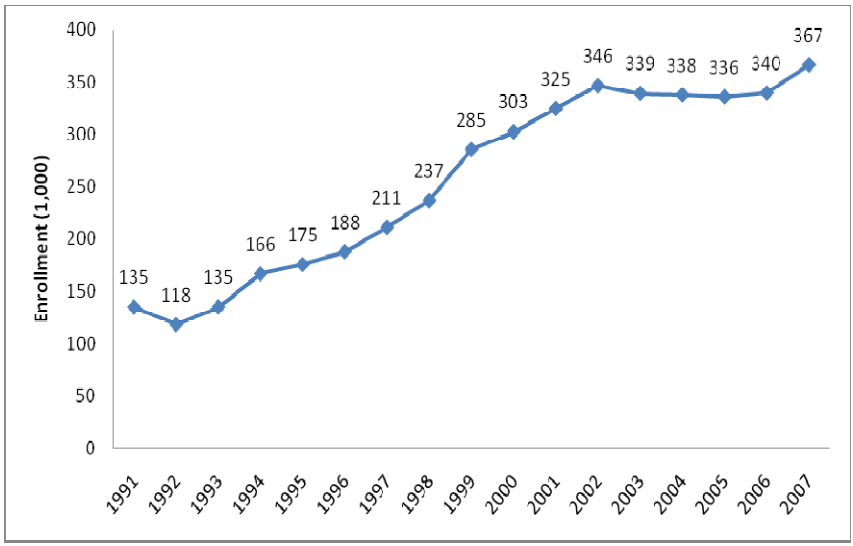
The State of Paraná has a large and diversified system of higher education: in 2008, there were 178 institutions and 330 000 undergraduate students. A distinctive feature is the dominance of state institutions, which is

among the largest in the country: 17 out of 22 public higher education institutions are state institutions, a proportion that is only surpassed by the State of São Paulo. Reflecting Paraná's relatively high per capita income (8.6% above the Brazilian average), the size of its higher education sector is above the Brazilian average. Paraná hosts 9.3% of all public universities in Brazil, representing 8.7% of the national enrolment.

Out of the 178 higher education institutions in Paraná, 12 are universities, 7 are university centres (with fewer programmes than universities) and 159 colleges specialised in one or few programmes. The state offers 1 831 programmes (*e.g.* engineering, education, psychology) at the undergraduate level, representing a national share of 7.4%.

Paraná's total undergraduate enrolment – close to 330 000 (2008) – represents 6.5% of the national enrolment. Every year, over 111 000 new students are admitted to higher education institutions in Paraná, representing 6.5% of the national figure. Figure 1 shows the development of higher education enrolment in Paraná since 1991. During the period of 1996 and 2007, on average, the annual enrolment grew at a rate of 6.6%, compared to the 1.1% of the population growth and 0.65% of the growth in the 15-24 years age cohort.

Figure 2.1. Evolution of total enrolment in higher education in the State of Paraná



Source: Drawn from INEP (2008), (National Institute of Educational Study and Research) (Sinopses Estatísticas da Educacao Superior – Graduacao, http://portal.inep.gov.br/superior-censosuperior-sinopse.

Higher education sector in Paraná is dominated by private institutions in terms of number of institutions and student enrolment. Around 66% of students are enrolled in private institutions, 52% in for-profit organisations and 14% in confessional or community non-profit institutions (see Table 2.1.). In terms of new admissions, the share of the private institutions is 74%, indicating a future increase in the share of total enrolment. Hence, more than half of the students in Paraná are studying in the private sector. These programmes are market-oriented, preparing for professions and providing skills in demand by the market. Low cost provision prevails in the private institutions, in fields such as law, management, IT (mostly, in the softest part of the field). Courses are offered predominantly in the evening, to allow students to combine work and study.

Table 2.1. Number of higher education institutions in Brazil and Paraná

	Brazil				Paraná				
	Univ	Uni Centres	Colleges	Total	Univ	Uni Centres	Colleges	Total	PR/BR %
Public	97	5	100	202	7	1	14	22	11
Federal	55		4	59	2			2	3
State	36		46	82	5		12	17	21
Local	6	5	50	61		1	2	3	5
Private	86	119	1 811	2 016	5	6	145	156	8
Private	29	63	1 487	1 579	4	3	120	127	8
Non-profit	57	56	324	437	1	3	25	29	6
Total	183	124	1 911	2 252	12	7	159	178	8
% Public	53	4	5	9	58	14	9	12	
% Private	47	96	95	91	42	86	91	88	

Source: Drawn from INEP (National Institute of Educational Study and Research) (Sinopses Estatísticas da Educacao Superior – Graduacao, (Higher Education Census) http://portal.inep.gov.br/superior-censosuperior-sinopse.

In 2000 (the last population census), Paraná had 6.9% of all Brazilians in the 25-34 age range with university education, which is above the state's share in population. Data from the 2008 National Household Survey (PNAD – *Pesquisa Nacional por Amostras de Domicílios*) indicates that 43.9% of the employed population in Paraná had 11 or more years of education, compared to 41.2% for the country as a whole. Moreover, 12.4% had 15 years or more, compared to the national average of 9.8%.

Paraná has a large number of graduate programmes delivered by a diversified group of institutions. The higher education institutions with the highest number of masters programmes are the Federal University of Paraná (Curitiba), with 55 master programmes (2 059 students in 2009) and 35 PhD programmes (1 141 students in 2009). This institution is followed by the

three largest state universities: the State University of Londrina (UEL), with 32 master programmes, 12 PhD and two professional master programmes; the State University of Maringá (UEM), which offers 27 master, 16 PhD, and one professional master programme; and the State University of the West of Paraná (UNIOSTE) which offers 16 master and two PhD programmes. The next in line is the private-non-profit Catholic University of Paraná (PUCPR), which offers 14 master and 8 PhD programmes. PUCPT is followed by the State University of Ponta Grossa (UEPG), with 11 master and 2 PhD Programmes, and the Federal Technological University of Paraná (UTFPR) with 9 master, 2 PhD and 2 professional master programmes. Other universities have smaller programmes, in terms of number of courses offered. Some of these have been recently implemented.

2.2 Access to higher education in Paraná

In Paraná, as in many other states in Brazil, a key determinant to equity of access to higher education lies in the quality of primary and secondary education systems. The quality of education in pre-university education system determines how well prepared students are to take admission examinations and how they progress in their studies. The admission examinations tend to be biased in favour of students from private high schools who have a considerable advantage when it comes to highly competitive university entrance tests (Salmi and Fèvre, 2009). In 2008, only 5% of all students in Brazil came from the poorest 40% of all households, and virtually all of these went to private institutions. In contrast, 57.6% of students came from the richest quintile. Over 90% of the students in public universities came from the richest 40% of households, and nearly three-quarters came from the richest 20% of households, (see Table 2.2.).

Federal and state universities in Brazil offer free tuition courses. They have the highest demand and are very selective in their admissions. Admission decisions are made on the results of the entrance examination and a proportionally higher number of accepted students come from private high schools. The drop-out rates of accepted students is higher for those who come from public schools.

Improvements of education at the primary and secondary level are necessary to ensure better preparation of all students. Students' learning outcomes are poor at primary and secondary education. While students in Paraná achieve better than average results in national testing, in international comparison (PISA) there is a considerable gap to be bridged both for students in Brazil and Paraná, indicating that there is considerable scope for improvement in the quality of teaching.

Table 2.2. Percentage distribution of students by income quintile in public and private higher education, 2008

	Quintile	Public	Private	Total
Lowest	1	0	1.50	1.30
	2	0	4.30	3.70
	3	8	11.70	11.20
	4	18	27.40	26.10
Highest	5	74	55.10	57.60
	Total	100.00	100.00	100.00

Source: PNAD (2008), National Household Sample Survey, PNAD, *www.ibge.gov.br/english/estatistica/populacao/trabalhoerendimento/pnad2008/default.shtm*.

Table 2.3. shows that while the average applications/admissions rate for Brazil is 1.9, for public institutions the rate is 7.1; in Paraná, the average ratio is 2 compared to 7.7 for public institutions. Admission to universities is 10% higher than in Brazil in general. According to the 2008 higher education census, it is 55% more difficult to be admitted to one of the 12 universities in the state than to an average university in the country; this applies to the non-profit private university (PUC), which is 28% above the national average for the non-profit private institution.

Student mobility in the 17-19 age range is relative low in Brazil and demonstrates a decreasing trend. While there is generally poor tracking of students in terms of origins and also destinations, undergraduate students in Paraná tend to come from the state and from the neighbouring regions. In 2001, approximately 12% of the students of the Federal University of Paraná (UFPR) came from other states; in 2009, the proportion had decreased to 9%. Similar share apply to the State University of Ponta Grossa (UEPG) (6%), the State University of the West of Paraná (UNIOESTE) (7%), the Federal Technological University of Paraná (UFTPR) (8%) and the University of Sao Paulo where only 6.8% of applicants of 2009 came from other states. However, in Paraná, the most competitive fields, such as medicine and engineering, attract students from other states, mostly from the neighbouring states of São Paulo, Mato Grosso do Sul and especially Santa Catarina.

Table 2.3. Application/acceptance rates in the State of Paraná, 2008

	Admission/application rate			
	Universities	**University centres**	**Colleges**	**Total**
Brazil	2.70	1.00	1.20	1.90
Public	8.00	1.20	2.80	7.10
Federal	8.20	-	22.1	8.00
State	9.20	-	5.40	8.80
Municipal	1.50	1.20	1.10	1.30
Private	1.20	1.00	1.20	1.20
Private	1.20	0.90	1.20	1.10
Non-profit	1.30	1.10	1.10	1.20
Paraná	4.20	1.00	1.20	2.00
Public	8.40	1.30	3.80	7.20
Federal	7.70	-	-	7.70
State	8.80	-	4.50	7.60
Municipal	-	1.30	0.80	1.00
Private	1.30	1.00	1.00	1.10
Private	1.10	0.80	1.00	1.00
Non-profit	1.60	1.60	1.20	1.50
Paraná/Brazil	1.55	1.03	0.97	1.10
Public	1.04	1.06	1.37	1.01
Federal	0.94		-	0.96
State	0.96		0.82	0.87
Municipal	-	1.06	0.70	0.77
Private	1.02	1.03	0.89	0.93
Private	0.92	0.89	0.87	0.88
Non-profit	1.28	1.45	1.07	1.19

Source: Drawn from INEP (2008), (National Institute of Educational Study and Research), *Censo da Educação Superior (*Higher Education Census), (Sinopses Estatísticas da Educacao Superior – Graduacao, (Higher Education Census) http://portal.inep.gov.br/superior-censosuperior-sinopse.

Initiatives to improve access

Federal and state initiatives to improve access to higher education in Brazil include: the ProUni Scholarship Programme, an affirmative action plan through quotas and student loans.

Programa Universidade para Todos (ProUni)

The ProUni scholarship programme has been in operation since 2005 and is aimed at placing academically qualified low-income students in private higher education institutions. Eligibility for ProUni financing depends on a passing grade in the ENEM examination and on family income. ProUni provides support for students who studied only in public high-schools (Maculan, Ribeiro and Haddad 2010). Full tuition fee scholarships are granted to students whose families have an income equal or less than one-and-a half minimum wages, while a partial tuition fee finances scholarships for students from families with an income no larger than three times the minimum wage. Full time students who receive the full scholarship are also eligible for a monthly maintenance grant. While ProUni works as a variation of a voucher scheme, ProUni scholarships do not transfer actual funds to the participating higher education institutions or to eligible students. The scholarship scheme is operated by granting tax exemptions to participating institutions upfront based on the number of scholarship students enrolled. (Since the amounts granted are typically smaller than regular tuition, institutions accepting students from PROUNI qualify for tax abatements.)

In Paraná, in the first semester of 2009, a total of 9 483 ProUni scholarships were offered to students, of which 5 615 were equivalent to full tuition. In the first semester of 2010, the number grew to 14 357 (5 222 in full tuition), representing over 6% of enrolment in private organisations. Students from 124 different cities received scholarships in the first semester of 2010. However, the capital city of Curitiba received 50.7% of all scholarships and 38% of full tuition allocations.

ProUni has become a significant source of indirect funding and has also removed some of the geographical barriers to education. Since transportation costs present a challenge for students from low socio-economic background, who for the majority study in evening courses, the impact in terms of aggregate numbers tend to be high. However, while ProUni has been acknowledged as an effective way of allowing students from low socio-economic backgrounds to enrol in private higher education, critics have pointed to the quality issues in the private higher education institutions, which feature high drop-out rates linked to tuition costs and quality issues.[1]

Affirmative action initiatives

Affirmative action policies have been developed in Brazil in order to increase participation in higher education by afro-descendents, indigenous

people and handicapped individuals as well as by students from lower income families. Affirmative action policies are enforced by federal law[5] although institutions have some degree of flexibility in their implementation. Special attention has been paid to the ethnic background of students with a quota system, which, in general, allocates 10% of places for new students from racial minorities and 20% to students from public schools (OECD 2010),

Research on international experience of affirmative action programmes indicates that they often fail in practice as they can have unintended outcomes by increasing racial tension and inherent difficulties in targeting participants (Salmi and Fèvre, 2007). One of them has stated that "the central problem is located in reducing poverty and improving the overall quality of basic and secondary education" (Makowiecky, 2007). This approach was introduced in Paraná campus of the Federal University of Southern Border (*Universidade Federal de Fronteira Sul,* UFFC) in 2007 and led to some controversy when students who had done well in the *Vestibular* were crowded out by others from the target groups who had done less well.

Until recently the undergraduate admission process was almost similar to all others in Brazil using the written *Vestibular* tests. In later years, this process of admission has been altered, the *Vestibular* has been replaced by another more contemporary examination, the *Exame Nacional do Ensino Médio (ENEM),* and in 2007 the institution approved a quota system proposed by the Ministry of Education, which allocates 10% of places for new students to racial minorities and 20% for students coming from public schools.

Student loans – federal and state financed

The main scholarship financing programme (for higher education) in Brazil is the Student Financing Programme (FIES, *Programa de Financiamento Estudantil*), initiated in 1999 to replace a previous loan scheme, the Educational Credit Programme. FIES is administered by the Federal Savings Bank (*Caixa Econômica Federal*) and provides loans (paid directly to the higher education institutions) to needy students who are not beneficiaries of ProUni to cover up to 50% of their tuition costs (students who are beneficiaries of ProUni can receive a loan of up to 25% of their tuition costs). Priority is given to students who scored well on the ENEM. The fixed interest rate is set by the National Monetary Council *(Conselho Monetário Nacional*) and, for contracts signed in 2006, was 6.5% (3.5% for students studying to be teachers). While attending a higher education institution, the borrower must make interest payments every three months up

to a fixed maximum. Repayment of the principal begins after graduation. For the first 12 months (phase I) following graduation, the student must pay monthly instalments that equal 50% of the tuition fee charged in his/her last semester. In phase II, the debt balance is divided into equal instalments and paid over a period of six years. In 2004, the system was reformed to remove guarantor requirements and to introduce weighting in the allocation of loans to minority ethnic groups (Buffalo University, 2010).

The State of Paraná also has a number of scholarship and research funds which are specifically targeted at increasing access for lower income students. These programmes provided total or partial remission of fees in ACAFE or private higher education institutions to about 13 000 students in 2008 and to an estimated 20 240 in 2009.

Easing financial pressures on needy students and improving the availability of support to ensure the participation of disadvantaged students would improve access. Salmi and Fèvre (2009) have recognised the possible modifications to the Federal Student Loan Scheme including the review of the eligibility criteria to enable only students from low and middle income families to benefit from subsidised loans. The authorities in Paraná are recommended to review the state level student aid programmes with the view to easing the financial burden of attending higher education and ensuring that all needy students have access to financial aid.

Expanding existing universities and establishing new universities

The state and federal governments have supported the expansion of higher education through collaborative extension activities and new campuses and institutions to reduce the geographical and social barriers to higher education. Notable initiatives include a university extension programme, "University without Borders", and the federal government's REUNI programme. The International University of Latin America, UNILA, represents an opportunity to strengthen Paraná's international position in the Mercosul area.

In 2007, the Federal Government in Brazil launched an ambitious REUNI programme to expand and restructure the federal university sector (*Programa de Apoio a Planos de Reestruturação e Expansão das Universidades Federais*) with the aim to widen access to at least one third of all citizens in the 18-24 age cohort and to improve the quality and relevance of the learning programmes. The application process included a need-based assessment to ensure better alignment with local and regional needs. The REUNI process facilitated adoption of new teaching and learning methods. Universities have had to commit to targets and goals, including curriculum redesign, to allow for more flexibility and a multi-disciplinary aspect.

Despite limited data on the outcomes of REUNI, it can be assumed that REUNI has widened access for students from low socio-economic background and from ethnic minorities and also produced new and innovative programmes.

An example of the REUNI initiative is the new campus of UFPR Litoral, in the coastal city of Matinhos. Established in 2005, the university now offers undergraduate courses in agro-ecology, arts, sciences, physiotherapy, environmental management, entrepreneurship management, public management and social services. It also offers continuing professional education for workers in tourism and hospitality, nursing, real estate management, and community development. These programmes and contents were developed to meet regional needs.

The State of Paraná has assumed the responsibility of widening access to higher education by establishing new study opportunities through the University without Borders project (*Universidade sem Fronteiras*, USF).

Box 2.1 University without Borders (USF)

The *Universidade sem Fronteiras* (USF), is a university extension programme launched in October 2007 to boost the higher education offering in lagging areas of Paraná. The programme, co-ordinated by the State Secretariat for Science, Technology and Higher Education (SETI), calls for co-operation between the six state universities, the two federal universities and seven state faculties providing the teaching staff. The focus is on the disadvantaged areas of Vale de Ribeira and the Central region, which have the lowest Human Municipal Development Index (IDH-M) in Paraná.

Education and training programmes in USF target six priority fields: *i*) support to family farming and dairy production, *ii)* agro-ecology, *iii*) technological extension within firms, *iv*) training of social leaders, *v*) cultural dialogue and vi) support to basic education.

Since its launch in 2005, USF has delivered 4 000 scholarships for beneficiaries involved in 451 different projects in close to 280 municipalities. The state government has invested BRL 40 million in this programme by the end of 2010.

Source: PRSC (Paraná's Regional Steering Committee), Cassio R. and M. Serra (*eds*) (2010), "The State of Paraná, Brazil: Self-Evaluation Report", OECD Reviews of Higher Education in Regional and City Development, IMHE, *www.oecd.org/dataoecd/24/53/45420606.pdf*.

The rapid increase in higher education enrolment has contributed to high dropout rates, particularly in private institutions. Throughout Brazil in 2009, 20.9% [10.5% (public) 24.5% (private)] all students drop out before completing a degree, in comparison with the OECD average of 29.6% (Censo do Ensino Superior (Higher Education Census) MEC; OECD, 2010a). The reasons for educational failure are manifold, ranging from insufficient preparation of students in primary and secondary education to inadequacies in the university admission systems, quality issues, need to combine work and study, inflexible curricula and outdated classroom practices. In Paraná, robust data about higher education drop-out rates, students' academic progress is lacking both at the state and institutional level.

Concerns for academic failure do not feature high on the agenda of Paraná's higher education sector. As a result, academic and social support for students remains underdeveloped. The financial support has improved over the recent years, but is in need of strengthening.

Despite the existence of numerous higher education institutions and expansion of the federal universities, equity in access and success is an issue for many students. The source of inequality in access is partly due to a low socio-economic background or inadequate preparation in primary and secondary education. Disadvantage arises also for those students who may be able to attend a private institution only in the evenings because they are working to pay their fees and who, consequently, may not receive their first choice of full degree course. Enabling these institutions to attract day as well as evening students would enhance access and increase participation.

In the first instance, it is up to the school authorities to work towards improving the quality of education in Brazil and Paraná. At the same time, universities and other higher education institutions can and should reach out to local schools to improve the preparation for higher education. Some initiatives are already in place to this end. For example, the Federal University of Paraná has developed the Educational Development Programme (PDE) in partnership with the State Secretary for Education (SEED) to collaborate with teachers from the public education network in Paraná (RIEP in its Portuguese acronym). Recently, the federal government and federal universities have agreed about further education scheme for teachers. These initiatives focus on the improvement of teachers' discipline-based knowledge rather than their pedagogical skills. There is scope for long-term multi-stakeholder collaboration to improve the learning outcomes at schools. Successful international examples in this domain include the Access and Success programme at the University of Victoria in Australia and the El Paso Academic Collaborative in El Paso, Texas, which have both

achieved measurable success in widening access and improving success rates of low income students.

International examples in widening access and improving success in education

The ability of the higher education institutions in the region to widen access and increase educational attainment depends significantly on preparation in primary and secondary education. The El Paso Collaborative for Academic Excellence is a long term multi-stakeholder public-private effort, initiated by and based at the University of Texas at El Paso, to improve educational attainment and retention from the first year in school through college or university degree programmes. The collaborative includes membership from the business community, all levels of educational institutions (from primary through university), the public sector and a non-profit organisation concerned with improving educational achievement.

Box 2.2. El Paso: widening access to HE through broad-based long-term collaboration

The El Paso collaborative, launched in 1991, aims to make systematic changes in educational policy and curriculum in the 12 El Paso County School Districts to improve their performance and to decrease the achievement gap across ethnic and socio-economic groups. This approach has been successful, particularly in improving the performance of Hispanic students, a group with the largest proportion of low-income students and for whom English is usually a second language. Test results for Hispanic students in the critical 11th grade (a year before college entry) show improvement in performance from the 33rd percentile in 1993 to the 72nd percentile in 2008. Hispanic students show increases in enrolment in science, technology, engineering and mathematics related curriculum over the period of collaborative activities and a graduation rate of 76.7%, which is the highest among the large urban school districts in Texas. Given that Hispanic students make up 89% of the student population in the El Paso school district, improvement in their educational achievement has had a significant effect on the overall performance of the school districts.

HEIs benefit from the efforts to improve college readiness in the primary and secondary institutes, which includes obtaining grant funding to improve remedial education. El Paso Community College, with five campuses in the region, is the primary entry point to tertiary education for low-income students who are unable to pay for a four-year degree programme. As a result, enrolment rates increased 35% between 2002 and 2008 and graduation rates increased 92% during the same period.

Box 2.2. El Paso: widening access to HE through broad-based long-term collaboration (continued)

Programmes to increase college readiness and thus potential success in a four-year degree programme have resulted in significant improvements in mathematics, reading and writing measures, with, for example, the percentage of students assessed as college ready with respect to writing skills, improving from 35% in 2003 to 74% in 2008.

An innovative programme undertaken at El Paso Community College to improve educational attainment is the Early College High School Programme. This programme enables high school students to obtain credit for college level courses and reduce the time and money for completing a degree.

The University of Texas at El Paso (UTEP) benefits from efforts to improve college readiness by the primary and secondary institutes and the community college and has undertaken its own programmes to improve student performance. Over 70% of the UTEP students come from within the region. UTEP has increased its enrolment by approximately 40% since the late 1990s and the vast majority of the increase has been in Hispanic students, who have increased from below 40% of the student body to over 75%. Degree awards have risen from approximately 2 000 in the late 1990s to 3 500 in 2008. Attesting to the commitment to serve the bi-national and bi-cultural region, approximately 10% of UTEP's students are Mexican citizens.

UTEP has also taken specific steps to make higher education affordable and accessible to students who almost universally have to work to attend college. UTEP has undertaken programmes to change course scheduling, enable students to borrow money to purchase books needed for courses during the semester and pay for their education as they acquire the funds to do so. The programmes are particularly important given the low-income levels of the college age population and their households, their lack of familial experience with higher education, their need to combine work and study and propensity to avoid borrowing to invest in higher education.

Source: OECD (2010b), *Higher Education in Regional and City Development, Paso del Norte Region, Mexico-United States*, OECD, Paris.

A comprehensive approach to widening access to tertiary education is provided by Victoria University in Australia, whose catchment area is one of the fastest growing but poorest areas of Melbourne. The university serves a student population with a higher than average representation of students from low socio-economic and non-English speaking backgrounds. Victoria University's work demonstrates a strong commitment to collaboration

across sectors. It involves both school and community partners in designing and delivering interventions to increase their relevance to particular contexts. It builds relationships between school students and mentors, such as university students or prominent community figures. It constitutes early, long-term and sustained interventions. Some projects take a cohort-based approach to changing student attitudes and peer culture in relation to education in order to improve achievement and aspirations for future education and employment. For example, Victoria University's Access and Success programme comprises different "arms", which involve university staff and students working in schools (Learning Enrichment), professional development of teachers via participation in post-graduate education (Teacher Leadership), working with senior secondary students to support their aspirations and provide information on pathways to tertiary education and employment (Youth Access), enhancing students' educational engagement through school-based programmes with community partners (Schools Plus) and developing and disseminating research (Access and Success Research). (OECD, 2010c) (See Box 2.3).

Box 2.3. Victoria University's Access and Success programme

Victoria University provides both higher education and technical and further education. It has over 50 000 local and international students enrolled at campuses across the city-centre and western suburbs of Melbourne that experience below average educational outcomes. The Access and Success programme works with schools in the west of Melbourne to improve access to, and successful participation in post-compulsory education. It has established teaching and research partnerships with schools and implemented programmes in more than 70 different sites.

"Learning Enrichment" involves learning teams of school and university staff and students. Continuous university presence in schools improves student achievement and raises aspirations. Pre-service teachers work with in-service teachers and university researchers to design action research projects that investigate student disengagement and participate as literacy mentors in a whole-school literacy intervention, while also researching the impacts of this intervention on school staff.

"Teacher Leadership" aims to engage teachers and principals in professional learning that increases teaching capacity in the schools. This has involved delivering professional development that articulates with the university graduate certificate or masters of education programmes. Research partnerships are based on participatory methodologies, which give teachers and principals control over the research agenda in their schools.

Box 2.3. Victoria University's Access and Success programme (continued)

Schools Plus builds school-community connections and increases the engagement of students and families with education and community life. The Kinda Kinder programme (launched in 2005) seeks to address low levels of pre-school participation by engaging with parents and children. Children attend once a week with a parent or a caregiver for one hour free programme in public libraries, other community settings and schools.

Pre-service early childhood teachers provide education through storytelling and other play activities, while supporting parents to develop social networks and familiarisation with formal education and community services. In 2009, Kinda Kinder operated in 19 sites across the western region of Melbourne.

A new generation of adult learners including parents and grandparents are learning along with the children, the pre-service teachers and university staff in the Kinda Kinder setting. Kinda College is being developed in conjunction with the vocational higher education part of the university and will offer parents the opportunity to gain further education accreditation for the skills they develop. A range of quantitative and qualitative research methodologies is used to evaluate and inform collaborations with school and community partners and to track the impact of the projects. This investment in research and the emphasis on building of community capacity through cross-sector and cross-agency partnerships has increased the reach and sustainability of the project.

Source: Sellar, S. *et al*. (2010b), *Interventions Early in School as a means to Improve Higher Education Outcomes for Disadvantaged (Particularly Low SES) Students: Case Studies of Selected Australian University Outreach Activities, Department of Education, Employment and Workplace Relations, Canberra.* OECD (2010c), *Higher Education in Regional and City Development. State of Victoria, Australia*, OECD, Paris.

2.3 Relevance and labour market linkages of higher education

Career counselling and sources of information to help students choose a career are not generally available at school level in Paraná. There is, however, a variety of accessible sources of information about the availability of courses in higher education institutions. For example, the National System of Higher Education Evaluation (SINAES) operates an informative website that covers all higher education courses throughout Brazil. However, there is no source of information about the possible labour

market implications of career choice, such as the Chilean *Futuro laboral* (www.futurolaboral.cl).

There is considerable variation among the higher education institutions in making an effective linkage with the skill needs of Paraná and aligning education provision with the regional needs. For example, the Federal University of the Southern Border has a focus on agronomy, aquaculture, rural development, agro-industrial management and food engineering. Federal Technological University of Paraná (UFTPR) stands out for its commitment to strong alignment with the industry needs, mandatory work placement for all students and specific locally-based university programmes. UFTPR takes advantage of mandatory internships and alumni networks as a channel to receive feedback about the relevance of education.

The leading private institution, Catholic University of Paraná (PUCPR) has a regional vocational mission and provides also community service learning opportunities for undergraduate students through a 36-hour mandatory community project (*Projeto Comunitário)* in which students develop social outreach activities in areas different from their field of study (see Box 2.4). PUCPR is often perceived as more "business-facing" in terms of its capacity to respond to the needs arising from industry.

Box 2.4. PUCPR's community project: addressing social concerns as part of the learning process

Established in 2002 by PUCPR, the *Projeto Comunitário* consists of a 36-hour mandatory activity for students of all fields. Students engage in activities outside their professional field, and can choose from projects designed by the *Núcleo de Projetos Comunitários*, from the *Pro-Reitoria Comunitária de Extensão*. The purpose of the programme is to introduce students to new challenges, including citizenship and social responsibility. The cost to the university is low, basically involving designing and organising the projects, approaching social institutions for partnership and involving faculty in the monitoring and evaluation of the activities. No additional fee is charged to students.

Since its inception in 2002, the number of academic programmes involved in the *Projeto Comunitário* has increased from 21 to 54 in 2008. Partnerships were formalised with the government institutions government and the Third Sector, starting with 22 organisations in 2002 and increasing to 111 in 2009. The number of students involved is more than 7 000.

Box 2.4. PUCPR's community project: addressing social concerns as part of the learning process (continued)

In 2008, students had the possibility to choose from 3 887 different activities. One example is the programme for students of journalism, *Comunicação Solidária*. A group of students, guided by a faculty, produced a radio show on Third Sector activities, including publicising the activities developed by students in *Projeto Comunitário* as well as activities developed by the partner institutions.

According to students' evaluations in 2006, 19% of students perceived the programme as an extension of PUCPR's humanitarian and religious objectives; 14% as a form of comprehensive education, another 14% as an enriching academic activity, and 12% as a good teaching strategy.

Source: Anastácio, M. D. Brecailo, and D. Fialho, *Educação, para a sensibilidade social e consciência planetária: o Projeto Comunitário da PUCPR, www.pucpr.br/ensino/proj_comunitario/documentos/ProjetoComunitario-EDUCARE-2007-20versao-final.pdf.*

Despite the progress made, positive development in improving the labour market relevance is taking place in a handful of institutions. Initiatives to improve labour market relevance of higher education remain in most instances discipline-based and/or driven by individual academics. As a result, only a small proportion of students benefit from the innovative approaches. Furthermore, to improve the labour market relevance of education and to boost entrepreneurship, there is a need to align education programmes with the regional needs and focus on students' learning process and outcomes. Several larger higher education institutions in Paraná are primarily focused on national labour markets and career-focused education provision.

The most common model of work-based learning in Paraná is internships, which provide students with a hands-on experience in the labour market. Internships also help companies to reduce labour costs and identify new employees. Brazilian Labour Law allows firms to avoid payment of fringe benefits to interns, provided that the relationship between the educational institution and the employer is formalised through a memorandum of understanding. Due to high indirect labour costs, the incentive for employers to use interns is strong. While the federal law has reduced the number of hours to six hours per day[2] in order to allow sufficient time for students to focus on their studies, there is anecdotal evidence that irregularities and distortions still exist.

There is limited evidence on the number of students who take part in internships, the length of these internships, the impact of these arrangements or the number of sectors of industries/employers that benefit from these arrangements.[3]

There is also a lack of robust data on student progress and achievements, employment outcomes and graduate destination at the institutional or state level in Paraná. Most institutions have *ad hoc* information about how their graduates are performing in the labour market. A feasibility study to establish the potential employability of graduates is conducted by higher education institutions as one of the prerequisites for first-time institutional or government course approval. However, once the course has been approved, systematic evaluations of its relevance are no longer conducted.

There is some evidence of brain drain to neighbouring Santa Catarina and Sao Paulo. The private sector, jointly with academia, is now making efforts to present career opportunities in Paraná to prospective students. Since 2006, a Research and Innovation Exhibition has been organised in Curitiba with the participation of Federation of Industries of the State of Paraná (FIEP), Catholic University of Paraná (PUCPR),[4] Universidade Positivo, Federal University of Paraná (UFPR), and Federal Technological University of Paraná (UTFPR), presenting a good example of co-operation between industry and higher education institutions as well as one of useful inter-university co-operation.

There is scope to improve dialogue between university and industry leaders. Discussions on the creation of new courses or the launching of research activities do not appear to feature regularly on the agenda of the local FIEP representatives, academia and local/regional authorities. According to the industry representatives, this has resulted in a mismatch of labour market supply and demand, *e.g.* in terms of engineers and technicians, a lack of life-long training opportunities within higher education institutions and duplication of study programmes in higher education institutions and courses between departments within some institutions. Stronger institutional channels should be developed through which universities and companies, business and industry and organisations of civil society could meet.

Private higher education institutions, which are dependent on student enrolment, are often more aware of demographic trends and collect statistics to better understand the labour market trends. They rely on informal feedback from employers and graduates through various channels such as meetings with local chambers of commerce and business associations and demonstrate flexibility in their willingness to monitor the relevance of their programmes and introduce new courses and modify or drop existing courses

as required by student demand or possible overlap or duplication with competitors. Because academic staff is hired often on a part-time or hourly basis, the only constraint in the process of reassessment of the education provision is the ability to gain accurate picture of demand and their capacity to develop high quality courses.

Federal regulations may also act as a constraint in aligning education with the regional needs and opportunities. In the public sector, the selection of courses and course contents to be offered by any specific undergraduate programme is not entirely a choice of the institution. The Ministry of Education issues general guidelines for each programme, which must be followed by individual institutions. Furthermore, each profession is monitored by a professional council, with a national office and branches in each of the 27 states. These councils establish a list of subjects that must be included in each programme. In most cases, this list is long and leaves limited room for the inclusion of other subjects. This leads to the standardisation of the programmes and a potential mismatch between the needs of a specific region/sector and the contents of the higher education programmes.[5]

Despite current constraints in the higher education system, there is scope for moving towards more demand-led education provision, greater alignment of courses with regional needs, strengthening the development of competencies of the students and building stronger links between higher education institutions and labour market. This could be achieved through a wide range of measures, including credit-bearing work-based and co-operative learning for students, introduction of problem-based learning methods in collaboration with the local industry and other employers, as well as participation of employers in the curriculum and course design. In addition, the use of local private sector employees as instructors and supporting the movement of university researchers/teaching staff on a temporary basis to the private sector would be useful ways of improving the labour market relevance. Finally, there is also a need to develop robust data about students' employment outcomes and graduate destinations.

International examples of university-industry collaboration

Internationally, many universities and other tertiary education institutions are building closer, more systematic links with the world of work. For example, the University of Rovira i Virgili in Spain has established a long-term collaboration with the chemical industry in Tarragona that incorporates both research and human capital development programmes that are relevant to the industry needs. University faculty are allowed to spend time working in local firms during their leaves and have

on-going relationships with the firms. There are strong alumni connections and students participate in internships and co-op programmes within the local firms. Both advanced technical vocational skills and higher degree based skills, such as in engineering, are designed in co-operation with the local industry representatives. To better serve the small and medium-sized enterprises, a public sector intermediary is being developed. Most important to the success of this integrated initiative is the strong support from the university leadership, including the Rector (OECD, 2010d).

Some universities, such as the University of Aalborg in Denmark, have taken steps to embed employability and transferable skills in their core curriculum through problem-based learning in multidisciplinary teams (see Box 2.5). The knowledge economy requires competences in identifying, understanding and creating knowledge, the capacity to understand the potential and risks of new technologies, and creative and innovative approaches to problem-solving, decision-making, communication and collaboration (Schleicher, 2011). The development of these skills and mindsets is facilitated by problem-based learning, which provides opportunities for students to work on real-life problems. In addition, there is evidence that problem-based learning fosters social and academic integration, between students and teachers and also between students themselves, which in turn has a positive effect on study progress and completion (Severiens and Schmidt, 2009).

Box 2.5. Problem-based learning at Aalborg University

Aalborg University was established in 1974 after years of popular campaign in the region to establish a university in northern Jutland in Denmark. The campaign formed the basis for a close dialogue with the surrounding society, relying on cooperation with the business sector, trade unions and cultural life. An important early decision was to base research and educational activities on interdisciplinary integration, problem orientation and group work.

In project-oriented problem-based learning, study programmes are organised around interdisciplinary project work in groups. Up to 50% of the study is problem-oriented project work: student work in multidisciplinary teams to solve real-life problems which have been defined in collaboration with public and private sector and NGOs. At any one time, there are 2 000 to 3 000 ongoing projects to ensure a high degree of collaboration with the society and private sector.

Box 2.5. Problem-based learning at Aalborg University (continued)

The Aalborg model is based on a win-win situation: It provides students with transferable skills and authentic work experience while enterprises benefit from a clearer picture of what the university stands for and how students might fit in as prospective employees. Finally, the university gains feedback from the world of work and also benefits from access to instructive cases and ideas for research and teaching.

Source: OECD (2007), H*igher Education and Region – Globally Competitive, Locally Engaged*, Paris, OECD.

International examples of close industry-university collaboration in educational programmes also come, for example, from Canada where the University of Waterloo is running the largest co-op programme in the world with more than 11 000 students and 3 000 employers (see Box 2.6).

Box 2.6. The Co-operative Education Programme at the University of Waterloo, Canada

The Waterloo Region in Ontario, located about 100 km west of Toronto, has a strong factor advantage of a rich local labour pool largely as a result of a strategic decision made at the inception of the University of Waterloo. The founding document for this university in the 1950s (the Waterloo Plan), called for a new type of education to be offered on a co-operative basis with industry. The rotation of students to industry and back to the classroom solidified the university's relations with local industry. Today, the University of Waterloo has the largest co-operative education programme in the world, with over 11 000 students (60% of the student body) and 3 000 employers involved in the programme each year.

Extensive co-op programme offerings are available in all faculties and departments and in over 100 different programmes. Many of local and global firms have strong links with the co-op programme. At Sybase, an enterprise software company that spun-off from the original WATCOM Corporation, with over 250 employees in its Waterloo campus alone, 15% of its current employees are Waterloo co-op students, and more than half of their Waterloo staff is former co-op students.

Box 2.6. The Co-operative Education Programme at the University of Waterloo, Canada (continued)

The co-op programme brings a number of benefits to the local economy. It acts as a steady source of new hires because firms know that the students have work experience; and they get an opportunity to evaluate their performance in the work place before hiring them. Students act as an important transfer mechanism for tacit knowledge and know-how; they also act as a critical source of knowledge circulation within the local high-technology cluster, between different firms as they undertake placements over the course of their integrated work-study programme. The relationship between the university and local industry allows the curriculum to keep up-to-date with the changing technological frontiers of industry while industry support of the programme funds the acquisition of technology to enhance classroom learning.

Furthermore, the Enterprise Co-op Programme enables students to start their own venture instead of doing a co-op placement with an established firm, and focuses on creating a local network of contacts and mentors to support it. The principal obstacle to the success of the Co-op Programme is the high cost of finding and maintaining the placement positions for the student body. The university invests a considerable amount of its own resources in financing and managing the programme. However, it now benefits from the high reputation that both the programme and the university's students enjoy, which makes it easier to find firms willing to take the students on work placement. The key lesson to be drawn from this experience is that the investment of resources in a programme such as this can pay dividends to the local economy over a long period of time.

Source: Marchese, M. and J. Potter (2011), "Entrepreneurship, SMEs and Local Development in Andalusia, Spain", *OECD Local Economic and Employment Development (LEED) Working Papers*, No. 2011/03.

Continuing education and new models of delivery

Due to rapidly changing skill requirements in working life, lifelong learning, skill upgrading and re-skilling are becoming increasingly important. Upgrading the skills of the adult population is likely to have a more direct effect on the region's economic performance since adult learners are generally less mobile than younger students due to family commitments. For non-traditional learners, who often combine work and study, and their employers, flexible ways of provision need to be in place through work-based, e-learning and distance education. In addition, attendance on the

basis of non-formal and informal learning should be allowed (OECD, 2007a).

Brazil has relatively weak traditions in lifelong learning, continuing education and continuing professional development in the higher education sector. In some professional areas, such as in medicine, dentistry and management, extension courses are common. While the private higher education sector is active in exploring market opportunities,[6] the quality of some of the short courses and the accreditation of the institutes that sponsor them remain a worry. The current practice of charging fees in the not-for-profit sector is an obstacle to those who might most benefit from additional learning opportunities and will be an obstacle to the development of an equitable lifelong learning system.

The public higher education sector is limited by its human resources, and also by the difficulties associated to charging tuition for these activities. Although professionals are interested in updating their knowledge in the public institutions, and willing to pay the necessary costs related to the activity, bureaucratic limitations act as a constraint to public institutions to offer fee-funded programmes. In Paraná, some higher education institutions have established separate institutions (foundations) to deal with the challenge, but these are also under scrutiny by the judiciary system, as well by part of the academic community.

Despite some promising examples of progress in continuing education, for example, the highly active extension programme of Pontifical Catholic University of Paraná (PUCPR), in general, the higher education institutions in Paraná remain more oriented to meeting the needs of traditional students than those of adult learners. While public universities face internal constraints due to the introduction of fees for lifelong learning activities, they also target their efforts narrowly, to adult learners with university degrees. Currently, there are no mechanisms for recognition of prior informal or non-formal learning. Furthermore, while the higher education institutions are aware of the needs of adults and have some programmes in place for them, not enough robust data is available to understand the needs of this population or the efficacy of higher education in meeting them. The Federation of Industries in Paraná (FIEP) has conducted a review of the skills need in the Paraná, but this has been a one-off study.

Flexible ways of provision should be scaled up for the benefit of non-traditional learners, who often combine work and study. Paraná's higher education institutions could also consider the experiences from Germany where dual programmes have been introduced to help combine work and study (see Box 2.7)

Box 2.7. Integrated and dual study programmes

The FHK model (Fachhochshule Koln) of study programmes was initiated in the mid-1990s by the University of Applied Sciences in Cologne to tie their curricula and applied research activities more closely to the regional economic needs. Tailor-made study programmes were established: First for a bank group (Sparkasse), and later extended to bachelor's and master's programmes, for example, in railway engineering.

The bachelor's programmes facilitate study parallel to work and are designed to prepare for specialised tasks. Initial professional training on an advance level is provided in a lifelong learning setting. The required period of study is three years (six semesters). The weekly schedule of the first year is two days study and three days work and in the second and third year three days of study and two days of work. Study is comprised of 20% class-room teaching, 60% individual study and 20% mentoring and occasional tele-tutoring. Students also undertake projects. In some bachelor programmes, students are awarded two credentials: a vocational certificate from the local chamber of commerce after 2.5 years and a bachelor of the FHK after three years. In addition, a full-time master programme was established tailor-made for management of construction. The partnerships help the universities to enlarge and qualify its personnel capacities for teaching and research.

The university and the enterprises co-operate in curriculum development. The university is in charge of quality control and teaching with part-time teachers from the enterprises. A university professor serves as programme director, and each programme has a board with representatives of the partners; the co-ordination is rearranged when the initial funding model is terminated. The stakeholders include: FHK Institute of Insurance, Zurich Group, German Academy for Insurance, FHK Institute of Economics, Sparkasse (local bank), FHK Institute of Civil Engineering, German Rail, Economic Univon Building Industry, German Association of Medium-Sized Building Companies – Working group Rail, Training Centre of the Building Industry in Kerpen.

Source: Mora, Detme and Vieira (2010), *Good Practices in University-Enterprise Partnerships*, GOODUEP, www.gooduep.eu

The Paraná state government could also consider the US experience, in which community colleges play an important role in strengthening the local capabilities for innovation. Much of the community colleges' workforce training is state-sponsored and charge-free to employees. Approaches vary from a one-stop-shop such as the Georgia Quick Start programme and to a centralised service offered by 58 community colleges in Northern Carolina (see Box 2.8).

Box 2.8. Free, employer-specific training in the US

The Georgia Quick Start programme

The Georgia Quick Start programme offers a number of innovations in the process of training for job-specific needs in new technology. An arm of the 33 campus Technical College System of Georgia (Georgia does not use the term "community college"), it is located in close proximity to the State Department of Economic Development. The programme is free for new employers, but also for existing companies that are increasing employment and/or making substantial upgrades in plant and equipment. Quick Start has the centralised staff, resources and experiences to quickly develop and deploy customised training anywhere in the state. The basic programme, carrying Georgia's commitment to provide free training for new and growing businesses, dates back to 1967. The state ramped it up in the 1990s after finding that offshore competitors were undermining the state's traditional cost competitiveness. By early 2010 it has conducted almost 6 000 projects involving 780 000 trainees. The basic budget is USD 22 million a year, at times that is supplemented with extra funds allocated as part of the incentive package for a major plant.

When qualifying employers want training or retraining for their workers, Quick Start assigns teams of analysts to examine the process of workflow in question. Then it develops a customised training programme, complete with handbooks, presentations, videos, online lessons or other training material produced by its own specialists. For all new projects, Quick Start will pre-screen potential hires for the company, using the technology it has acquired of the production system to match candidates with the skills required. The training is deployed at the company location, at one or more of the technical colleges or at any five Quick Start facilities located around the state.

Box 2.8. Free, employer-specific training in the US (continued)

North Carolina Community College Collaboration

In North Carolina, the provision of free, employer specific workforce training began in community colleges in 1958. Currently, North Carolina Legislature provides USD 12.4 million a year for its customised training programme. Each of North Carolina's 58 community colleges can access the funds to design and deliver training tailored to the specific needs of a new or existing company without charge to the company. North Carolina is looking to help businesses that grow its economy. The company must demonstrate that it is making an appreciable capital investment, deploying new technology, creating new jobs or expanding an existing workforce or enhancing productivity and profitability. The training programme is developed at the local college in concert with the employer. Colleges design the programmes and share their experiences. Each community college has an employee assigned to reach out to local business and industry, identify their training needs and find ways to meet them. The cost of this post is shared by the state and the local college.

For the five years leading up to the current recession, North Carolina community colleges averaged training 26 277 employees a year at an average of 774 companies a year. The recession cut that to 19 861 employees at 671 companies in 2008/09. The cost to the state averages about USD 500 per employee. For example, Talecris Biotherapeutics has a longstanding training relationship with Johnston Community College. Every year the facility's production is put on hold for three weeks for maintenance and upgrades while the entire 550 person manufacturing workforce goes to training classes operated by the college.

Source: Shaffer, D.F. and David J. Wright (2010), *A New Paradigm for Economic Development, in Higher education*, The Nelson A Rockefeller Institute of Government, March 2010.

Distance education

Distance education courses in Brazil are accredited by the Federal Ministry of Education. In 2008, 115 institutions offered 647 distance courses nationwide and enrolment in distance education increased by 96.9% over the previous year and now represents 14.3% of total national enrolment in higher education. The number of graduates in distance education grew by 135% in 2008 compared to 2007. For example, in Santa Catarina, the

neighbouring state of Paraná, the University of Southern Santa Catarina is among the largest providers of distance education in Brazil.

Box 2.9 UNISUL

The University of Southern Santa Catarina, a municipal education foundation in Tubarão, claims to be the largest provider of distance education for undergraduates in Brazil. In 2008, almost 50% of the 41 000 students enrolled were in distance education. UnisulVirtual uses digital communication resources to allow students to have permanent contact with their tutors, with their class colleagues, with the institutional administrative departments and remote access to course content and learning activities. These students come from all parts of Brazil and beyond.

Whereas face-to-face students are mostly young and have recently finished high school and still live with their parents, in distance education, the students are adults and have jobs and are financially independent. The average age in face-to-face programmes is 21.7 years, and the average age of the distance students is 34.8 years.

UnisulVirtual created the Virtual Learning Space tool as the main resource for pedagogical mediation between teachers and students. The students also receive printed teaching material, CD-ROMs and DVDs to do their reading and simulation activities which are compulsory to the programmes. The tests requiring their presence are held in military organisations of the Army, Air Force, and the Navy and at partner universities throughout Brazil. The UnisulVirtual students can choose the city where they will sit for the examination, and this allows cost reductions on transport and adds flexibility and mobility to the model.

Within Unisul, UnisulVirtual also does the planning for the setting up and implementation of new distance programmes; co-ordinates the training of teachers and technicians in pedagogic methodologies in distance education; develops web technologies for distance education; and, in partnership with conventional education campuses of the university, promotes the offering of distance courses so that the face-to-face students can do up to 20% of their contact hours enrolled using the distance education resources, with flexible education.

Source: OECD (2010e), *Reviews of national policies for education: Santa Catarina State, Brazil*, OECD, Paris,
http://portal2.unisul.br/content/site/auniversidade/campusdaunisulvirtual/englishoverview.cfm

The development of distance learning in Paraná has made slow progress although it would provide opportunities to widen access to higher education.

A wide range of factors were reported as possible causes for the lack of progress in this field. These ranged from a mix of technical and pedagogical difficulties and a lack of incentives for individual staff members and institutions; to human resource limitations, training costs for staff, and international.

An example of distance education for the local public sector is the online extension course in ICT developed by the Federal University of Parana (UFPR) to the local government employees in Paraná. A total of 3 000 local government employees in 99 cities were trained on IT applied to public administration. The contents were developed in collaboration with the client. The use of online techniques helped improve the access to the course, allowing a large number of local administrators to upgrade their IT skills.

In Paraná, there appears to be a lack of awareness of the importance of tertiary and vocational education for the social and economic development of the state of Paraná among policy makers and the academic community. Paraná would therefore benefit from a state-wide lifelong learning strategy and has distinct strengths that can assist policy makers in the development of such a strategy. These include: *i*) a strong network of institutions spread throughout the state, which has the capacity to deliver courses to learners of all ages in either face to face or in distance mode; *ii*) a proliferation of evening courses and short duration professional and technological courses; and *iii*) an active private sector that encourages learning opportunities.

International examples also show that regional or state governments can play an instrumental in facilitating new modes of learning. For example, the Regional Government of Andalusia in Spain has been active in establishing favourable framework conditions for new modes of learning. The innovations that are transforming the Andalusian University System are based on modern technology, such as Open Course Ware (OCW) and virtual learning platforms.[7]

Programmes sponsored by the regional government include: the Virtual Learning Space (EVA) that provides continuing education to professionals in the labour market through virtual learning platforms organised by Andalusian Network of Technological Spaces (RETA) in collaboration with universities. EVA is co-ordinated by RETA who designs the programme and liaises with universities to identify teaching staff. It provides a response to the growing demand for e-learning in the labour market, which is not well covered by the universities (see Box 2.10).

Box 2.10. New modes of learning in Andalusian universities

The Regional Government of Andalusia launched Digital University Project in 2005 to provide the University of Andalusia System the means, resources and infrastructure for the knowledge economy. With an investment of EUR 20 million the programme has supported the development of*: i*) wifi network accessible to university community; *ii)* electronic library services; *iii*) classrooms for virtual computing; and *iv)* facilities for content digitalisation and the Andalusian Virtual Campus.

The Andalusian Virtual Campus (CVA), created in 2006, is designed to offer inter-university, virtual and distance studies to students within the Andalusian university system. It enables students to enrol in any of the 90 individual courses that are provided by the ten universities in Andalusia and are subject to annual review, mainly based on the student demand. Each university is required to provide a minimum of six courses. The enrolment process and updating of students' records is automatic and transparent for students. About 4 500 every year take advantage of this academic offer.

The Regional Government of Andalusia also supports other innovative initiatives, such as the Andalusian Virtual Campus, which was one of the spinoffs of the long-term and well-financed Digital University. The Digital University Project carries out technological updating, such as wifi, electronic services in libraries, computer classrooms and virtual campuses. This project facilitates distance and lifelong learning.

Source: OECD (2010g), *Higher Education in Regional and City Development: Autonomous Region of Andalusia, Spain*, OECD, Paris.

Entrepreneurship

Finding ways of increasing entrepreneurship could be an effective strategy for job creation. Higher education institutions have embraced entrepreneurship education in varying degrees. For example, the Federal Technological University of Paraná (UFTPR) has a course on business opportunities, focusing on entrepreneurship. This aims at providing engineering and science students with knowledge about the preparation of business plans, introducing them to the complexities of investment decisions. This effort is associated with the on-campus business incubators and the innovation agency, which deals with intellectual property and entrepreneurship.

Higher education institutions in Paraná have a growing, but offer limited entrepreneurship training, and which tends to be traditional in delivery. Entrepreneurship education is in an early phase of development, reflected in

the limited breadth of entrepreneurship education activities in most higher education institutions, the small proportion of students benefiting from them and the lack of co-ordination between the different departments and institutions. Currently, only limited practical experience in new venture formation is provided to students. Experience elsewhere shows that the best support for graduate entrepreneurship comes from teaching programmes where students work in teams to form real companies mentored by entrepreneurs. Such programmes could run at undergraduate and graduate levels and be targeted at students from across the sciences, engineering, business and arts disciplines.

Higher education institutions in Paraná should step up their entrepreneurship activities through a broad portfolio of activities and courses, enhance the institutional anchoring of entrepreneurship education, build capacity among entrepreneurship educators and integrate entrepreneurship education into the curricula. Provision of entrepreneurship programmes should be scaled up, focusing on growth-oriented entrepreneurship while not neglecting social and cultural entrepreneurship, and by using interactive and experiential teaching methods. Entrepreneurship instruction could be undertaken through a series of interactive, reality-based and experiential approaches. These approaches could include virtual or real business creations, business plan competitions, strategy games and discussions with entrepreneurs. These methods would support the development of key entrepreneurial competencies such as creativity, innovation, teamwork, understanding of external environments and networking. Entrepreneurship instruction should not be confined to economics and business departments but made available across other departments, particularly information and communication technologies, engineering and applied sciences. Rather than offering pure entrepreneurship degrees, entrepreneurship instruction could be integrated into the teaching of other subjects.

International examples of entrepreneurship education

Monterrey Tech, one of the leading entrepreneurial universities in Latin America, has a broad approach to entrepreneurship that ranges from a wide portfolio of high-tech spin offs to an impressive record in support of social entrepreneurship, including notable work in remote and rural areas. Entrepreneurship training is compulsory to all students. In 2009, altogether 8 900 Monterrey Tech students took part in entrepreneurship education provided by 118 lecturers. Year after year, Monterrey Tech boasts the highest number of patent requests in Mexico. In 2007-08, the research centres generated 23 spin-off companies and the network of business incubators and accelerators created 4 700 direct jobs in Mexico. The

Monterrey Tech has some of the best practices in business formation and regional economic development (see Box 2.11).

Box 2.11. Enhancing entrepreneurship in Monterrey Tech

The Monterrey Tech (Tecnológico de Monterrey or ITESM) is a private institution of higher education founded in 1943 by Mexican business leaders. Today, Monterrey Tech has 33 campuses throughout Mexico and 6 academic centres in Latin American countries. It also has international offices in North America, Europe and Asia.

Monterrey Tech has pioneered entrepreneurship education in a wide range of disciplines and is using interactive methods to provide all students with the skills that they need to create and develop their own businesses. Entrepreneurship is a mandatory requirement for graduation in all study programmes and interdisciplinary open innovation spaces are available in most areas of study. Moreover, each campus provides business incubators for for-profit enterprises as well as for ventures seeking improvement in social and community development.

The *Programa Emprendedor* (Entrepreneur Programme) was launched in 1985 to develop entrepreneurial skills of students as part of the curricula. In addition, in 2002, an entrepreneurial certificate was launched as an option in several campuses. In 2007, a bachelor degree in business creation and development was launched and today it is been offered in 16 campuses with minors in consulting, research & innovation and social development and with an opportunity to focus on business in Asia, business culture in China or globalisation. There are also three graduate programmes in entrepreneurship: master in innovation and entrepreneurial development through the virtual university, master in entrepreneurial and technological innovation in partnership with Babson College and master in family business creation.

The Monterrey Tech's Institute for Entrepreneurial Development (IDE) was established in 2006 to co-ordinate efforts in business creation and development. IDE has 26 business incubators, 14 business accelerators and 12 technology parks. In 2009, altogether 1 318 firms were involved in the IDE business development programmes; 1 068 of them in incubation phase ranging from pre-incubation to post-incubation, 198 in acceleration and 52 in technology parks. The Centre for Intellectual Property and Technology Transfer supports faculty members, students, investors and businesses with intangible asset and intellectual property valuation, commercialisation of technology developed by Monterrey Tech and acquisition of technology to create high-tech companies.

Box 2.11. Enhancing entrepreneurship in Monterrey Tech (continued)

The Angel Investors' clubs Network of Monterrey Tech integrates more than 130 private investors within the 10 established regional clubs. In addition, the Sustainable Social Development Institute is running 60 incubators for social entrepreneurship in different parts of Mexico to support regional development and the creation and development of micro-businesses in the community.

Source: OECD (2010b), *Higher Education in Regional and City Development. The Paso del Norte Region. Mexico and the United States*, OECD, Paris.

The University of Arizona in the United States has an award winning entrepreneurship education centre – the McGuire Center for Entrepreneurship – with a 25-year track record of entrepreneurship education. The McGuire Center is collaborating with the university's office of technology transfer to identify commercially viable faculty inventions and building entrepreneurial skills among the academic staff of the faculty (see Box 2.11.).

Box 2.12. The McGuire Center for Entrepreneurship

The McGuire Center for Entrepreneurship is located within the Eller College of Management at the University of Arizona and is ranked as the fourth best entrepreneurship programme among public universities in the United States, and tenth among all schools, according to US News and World Report. Founded in 1984 with the support of university alumnus and entrepreneur Karl Eller, McGuire was one of the first university-based entrepreneurship centres established in the United States and today one of the few to consistently maintain top-tier ranking status. In 25 years, more than 1 200 graduates have gone on to launch hundreds of ventures, often based on the plan they conceived in the programme.

McGuire teaches entrepreneurship to early-career business people, helps transfer research into the practice by identifying and transferring technology and innovations to the market place and serves on- and off-campus organisations through technical assistance on entrepreneurship activities. McGuire offers a limited-enrolment undergraduate degree stream, and entrepreneurship-focused MBA and a one-year Graduate Associates in Entrepreneurship.

Box 2.12. The McGuire Center for Entrepreneurship (continued)

The year-long academic programme is available to undergraduate and graduate students from all university disciplines and is completed during the regular course of study. The experience integrates the process of launching a venture into the Idea PathTM curriculum, delivering a hand-on exercise in entrepreneurship.

According to Impact of Entrepreneurship Education, part of a Kauffman Research Series report and the first study to measure the value of entrepreneurship education, McGuire Center alumni are three times more likely to start new business, be involved in a new venture or be self-employed; earn 27% more annually; have 62% more assets than non-entrepreneurial peers; and express greater work satisfaction, regardless of professional choice. McGuire produces about seven to ten start-up businesses annually from student collaborations. These start-ups have a significant economic impact, particularly in terms of employment. While a spin-off technology firm may employ two to three full time equivalent employees, a successful start-up (like Frost Gelato Shoppe, a McGuire start-up with two outlets) may employ dozens of employees. Despite the obvious success, the McGuire start-ups are not included in the spin-off figures released by the university's office of technology transfer.

McGuire collaborates with the university's office of technology transfer (OTT) in many different ways: it identifies commercially viable research in university and funnels technological innovators to entrepreneurship programmes; it offers workshops for university faculty to provide tools for assessing potential market and social value for their innovations; it hosts workshops for students and faculty to explore the implications of technologies available for commercialisations; it consults with McGuire venture teams on topics such as development, pro-of of concept and prototype creation via its on-staff technology mentors; and it helps to identify opportunities for collaboration in the university setting and beyond via shared McGuire/OTT knowledge transfer liaison.

McGuire Centre is also well networked outside of the university. As part of Innovation Frontier Arizona's Idea Fair for K-12 schools it is spreading entrepreneurship among school children across the region. McGuire also works with Southern Arizona entrepreneurs on projects including IdeaXchange – a referral network for emerging entrepreneurs – and the IdeaFunding Conference – a day-long workshop for business people, investors and university faculty. In addition to providing resources for new ventures in the region, these activities offer an opportunity for students to network with working entrepreneurs and learn about the issues affecting the entrepreneurial community in an informal setting

Box 2.12. The McGuire Center for Entrepreneurship (continued)

The McGuire Center has championed a number of innovations in embedding entrepreneurship into curricula: For example, it has developed a pioneering Business/Law Exchange™, a mock law firm staffed by law students, with entrepreneurship teams serving as clients, to address issues including intellectual property, patent law and contracting. It provides experiential learning opportunities for both students in law and entrepreneurship.

Source: OECD (2011, forthcoming*), Higher Education in Regional and City Development, Southern Arizona, United States*, OECD, Paris

Higher education institutions in Paraná could also share good practices among themselves and the key stakeholders in a more systematic manner. Examples of tertiary education institutions collaborating with each other and key regional stakeholders can be found, for example, in Brandenburg, Germany, where all tertiary education institutions (including universities and universities of applied sciences) have established a joint resource centre in entrepreneurship and small and medium-sized enterprises (SMEs) with the regional development agency in order to boost graduate employment and graduate entrepreneurship and provides services to the regions' SME sector. This initiative helps pool resources, gain critical mass and achieve cost savings (see Box 2.12).

Box 2.14. BIEM - The Brandenburg Institute for Entrepreneurship and SMEs

The Brandenburg Institute for Entrepreneurship and SMEs (BIEM) is the entrepreneurship institute of the regional development agency and nine public tertiary education institutions, including universities and universities of applied sciences. BIEM was founded in 2006 as a registered non-profit organisation. One of its main objectives is to reinforce, complement and co-ordinate the entrepreneurship support activities offered by Brandenburg's tertiary education institutions by pooling resources and enhancing collaboration and exchange. BIEM helps to achieve the "critical mass" needed to realise projects with wide ranging impact.

Box 2.14. BIEM - The Brandenburg Institute for Entrepreneurship and SMEs (continued)

The annual budget of EUR 100 000 is financed by the European Structural Funds, the Ministry of Economics of Brandenburg and other project-related revenues (*e.g.* fees for services). BIEM has eight employees. Each partner organisation runs additional projects and employs additional personnel according to project needs or the overall management of an entrepreneurship institute/centre.

BIEM's activities include entrepreneurship education, start-up support, entrepreneurship research and networking with business support organisations and other universities. It focuses on the expansion and better integration of entrepreneurship education into curricula, including innovative teaching methods, broad communication of activities, and an expansion of co-operation beyond BIEM's core partners (*e.g.* by involvement of university staff and external experts, agencies and companies). Partner tertiary education institutions benefit from rising numbers of students participating in entrepreneurship education activities and an increase in the number and variety of courses available for their students.

Tertiary education institutions have established "entrepreneurship location managers/animators" (Standortmanager), who act as "one-stop-interlocutors" for would-be entrepreneurs. This structure contributes to building stronger linkages between the university's internal and external support services and to integrating entrepreneurship education and start-up support services. Other projects include "Entrepreneurship ACs", which evaluate entrepreneurial potentials and learning needs before start-up and match them with adequate mentoring during start-up, "Team Competency Lab" that focuses on team building and coaching at the BTU Cottbus or GO: Incubator at the University of Potsdam.

In 2009, 370 would-be entrepreneurs received initial consultation by BIEM, 203 were referred to external business support structures and 86 business start-ups were supported. The key elements for the institute's success are the multidimensional co-operation between all tertiary education institutions and their external partners, the involvement of tertiary education institutions in regional leadership and a phase approach to entrepreneurship.

Source: OECD (2009), Universities, innovation and entrepreneurship: Criteria and Examples of Good Practice, OECD Publishing, Paris; and BIEM-Brandenburg (2010), Brandenburg Institute for Entrepreneurship and Small and Medium Sized Enterprises, website, *www.biem-brandenburg.de*, accessed 10 February 2010.

Skills development in tourism

Paraná has a potentially important tourism sector, representing 1.7% of the state's GDP and employing 203 000 people in 2009. Despite the importance of tourism to the economic development of Paraná, programmes to support education, training and RDI in tourism do not feature highly in the portfolio of Paraná universities. This is in contrast to many OECD countries and regions that are building skills to move to higher value-added segments in tourism. The leading university in hospitality and hotel administration is Cornell University in the United States, which provides education, R&D and innovation, as well as professional development opportunities in this increasingly global business. The school has also embarked on stronger internationalisation efforts and the development of students' entrepreneurial skills (see Box 2.15.).

Box 2.15. Cornell University School of Hotel Administration

Founded in 1922, Cornell University's School of Hotel Administration was the first higher education programme in hospitality management in the United States and is today the world leader in its field. Its students learn from 60 full-time faculty members, who are experts in their disciplines and dedicated to teaching, research and service. Learning takes place in state-of-the-art classrooms, in the on-campus Statler hotel and in varied industry settings around the world. The school's large alumni group of corporate executives and entrepreneurs advance the industry and share their experience with the students and faculty.

The school is active in industry relations. In 1973, it launched the first master's degree programme for the industry. This programme gives senior managers the knowledge and skills required in a complex global industry. Executive courses help industry leaders accelerate their careers. In 2006, the hotel school partnered with the Culinary Institute of America on a collaborative degree programme offering education in hospitality management and the culinary arts. Students earn a BSc degree in Hotel Administration and an Associate in Occupational Studies degree in Culinary Arts.

Box 2.15. Cornell University School of Hotel Administration (continued)

The school's Center for Hospitality Research (CHR) undertakes research on and for the hospitality industry. It creates new knowledge and shares that knowledge to develop the industry. Hotel school faculty, corporate partners and other industry leaders collaborate at roundtables and meetings to frame and understand the developments in the industry. Fellows work with business leaders to develop new ideas, theories and models that improve strategic, managerial and operating practices. These insights are captured in research reports and industry tools that are available online at no cost. An active knowledge-sharing programme distributes the Center's work around the globe. CHR also publishes the award-winning hospitality journal, the Cornell Hospitality Quarterly.

The hotel school is also widening its global reach. In 2004, it established a joint master's programme in hospitality management with Nanyang Technological University in Singapore. Launched in 2006, the Cornell-Nanyang Institute educates up to 50 students per class who split their time between NTU's campus and Cornell's campus in Ithaca, N.Y. The programme is the first joint degree programme for both institutions.

In 2006, Leland '69 and Mary Pillsbury announced a USD 15 million gift to the Hotel School. The gift, the largest single gift ever made to the school and one of the largest ever in hospitality education, supports the Leland C. and Mary M. Pillsbury Institute for Hospitality Entrepreneurship. Faculty teams with entrepreneurs to give students the knowledge and skills to pursue their entrepreneurial ambitions.

Source: Cornell University School of Hotel Administration , *www.hotelschool.cornell.edu*

In Europe, a number of countries have launched skills development programmes to train and up-skill personnel for tourism. Some of the programmes have a regional focus and emphasis on cultural tourism. This is the case, for example, with the Welcome Ireland programme ("Fáilte Ireland") that has funded a regionally-focussed capacity building programme for SMEs (see Box 2.14.). Similar initiatives were not in evidence in Paraná.

Box 2.16. Supporting workforce training and development in tourism

Major initiatives that are helping to enhance the status and position of the tourism sector as a career option include the United Kingdom's People 1st Programme and Canada's Tourism Human Resources Council, which emphasise stakeholder engagement as well as industry needs. These programmes highlight the need for long-term continuity in state policies and investment in tourism training and development to build the capacity of the workforce.

Ireland has made a sustained intervention through the funding of its national training body CERT which was merged to create Fáilte Ireland. It is one of the most comprehensive approaches to education and training, co-ordinating all education and training needs for the industry as well as labour-market planning. Fáilte Ireland trained 10 000 staff in the sector in 2007 to improve skills and industry capability to complement the higher level skills at the Institutes of Technology and Universities. Fáilte Ireland has also funded a Human Resource Development Strategy, Management Development Programme and a regionally focused capability building programme for SMEs.

Many OECD countries are using migration policies to address skills shortages in tourism since the financial rewards in the hotel and catering sectors are often uncompetitive. For example, the Scottish government's Fresh Talent Policy – a managed migration policy to attract returning Scots and overseas skilled labour – has addressed skills shortages in tourism and hospitality, notably in larger cities with high labour turnover rates. Here, eastern European labour has been used to fill significant skill gaps. In Canada, the Temporary Foreign Worker Programme helped streamline the time required to employ a foreign worker while also extending the length of time lower-skilled workers could stay in the country. A new scheme introducing faster processing of job applications helps employers facing labour shortages in high demand occupations such as tourism.

Source: OECD (2010g), *Tourism Trends and Policies 2010*, OECD, Paris. 2010.

Internationalisation

Internationalisation of higher education is an important component of national and regional education policies. A comprehensive internationalisation policy requires not only the exchange of students and staff, signing of agreements with peer institutions and participation in international organisations; but also a global, international and intercultural dimension in the teaching, research and public service activities on campus; as well as participation in the attraction of talent and foreign direct

investment to the region and linking local companies with the global networks.

In view of the important role that Brazil plays and will continue to play in the global scene, the country will need internationally-minded and capable human capital resources. Furthermore, Brazil's leading role in the MERCOSUL (Southern Common Market, *Mercado Comum do Sul*) region, encompassing Argentina, Brazil, Paraguay and Uruguay, calls for collaboration with the neighbouring countries. In this regard, higher education in Paraná will need to become aligned with the federal government's aspiration to improve international competitiveness. In general, most Brazilian universities have not given strategic importance to the process of internationalisation (Laus and Morosini, 2005).

In Paraná, rapid progress has been made to comply with the requirements of the MERCOSUL and the Federal University of Parana has played an important role in these efforts. Two key initiatives have been launched recently, namely the International University of Latin America, UNILA and UFFS (*Universidade Federal da Fronteira do Sul*).

The International University of Latin America, UNILA, was established in 2009, in the Brazilian frontier with Argentina and Paragua in Foz de Iguaçu right next to the ITAIPU Technology Park (*Parque Tecnologico de Itaipu*, PTI) where a state university (UNIOESTE) has a campus. It will develop into a multi-national centre of knowledge and research with important implications for the regional economy. UNILA began its operations with an initial enrolment of 1 000 students on a provisional campus in 2010 until the architectural project, designed by Oscar Niemeyer, is completed. Land for the campuses was donated by *Itaipu Binacional* (the legal structure created between Brazil and Paraguay that owns and oversees the operation of the Itaipu dam, which provides 20% of Brazil's energy needs and 90% of those of Paraguay.) UNILA, a multi-national venture for which UFPR provides support, aims to enrol 10 000 students and 300 faculty, half from Brazil, half from other Latin American countries; and provides teaching in Portuguese and Spanish. UNILA will also engage in studies with regional impact and capitalise on the high level research carried out in the ITAIPU Technology Park in areas such as environmental protection, water resource management and renewable energies. The Mercosul Institute of Advanced Studies (IMEA), created as part of the project, has conceived the graduate and post-graduate pedagogical programme emphasising natural resources management, social studies and regional development and integration. The creation of UNILA will reinforce the international dimension of regional development concerns and give added impetus to knowledge creation and dissemination in western Paraná,

with insertion into local society and the regional economy facilitated by an already well established learning environment.

Another initiative combining local development with international dimension with the MERCOSUL countries is the UFFS (*Universidade Federal da Fronteira do Sul*), which is a Federal University project that was launched at the end of 2009. UFFS involves the three states of the southern region in Brazil (Paraná, Santa Catarina and Rio Grande do Sul) and began its operations in March 2010 in the City of Chapeco (Santa Catarina). It will also have two campuses in Paraná (Realeza and Laranjeira do Sul). The institution will be based around the Mercosul frontier macro-region and its objectives are to ensure access to higher education in the region, facilitating regional development and collaboration between three states through education, research and extension. The 2 160 students will be studying in the multi-campus university with a particular focus on environmental matters, the food industry, agronomy, aquaculture and rural development. As the initiative aims to boost human resource development in this region bordering the MERCOSUL countries and encourage cross-border activities, Spanish language training is integrated into the curricula.

Despite the recent progress in the MERCOSUL front, in general, internationalisation remains uneven in Paraná's higher education institutions. The largest institutions have accomplished the most significant work in this area, but internationalisation has, with the exception of UNILA and UFFS, been confined to traditional activities such as the signing of international agreements with peer institutions, participation in international networks or associations, and the participation of a small number of students and faculty members in international mobility programmes. Limited attention has been given to efforts aimed at internationalising the curriculum of academic programmes, enhancing the international mobility of students and faculty members and fostering language learning or mobilising international links for the benefit of regional development.

Furthermore, in view of the ethno-linguistic heritage of Paraná, the lack of attention to language training in the higher education institutions is disappointing. The command of a second language is not common among most university students or staff. Concerted multi-stakeholder efforts are required to address this challenge.

Table 2.4. provides a review of the different components that an internationalisation strategy at the institutional level should ideally have, as well as a review of the gap existing between these components and the current situation of Paraná's higher education institutions. It is recommended that higher education institutions base their roadmap for bridging this gap on the difference between the stages as identified in the

table. By fostering higher education institutions at the state level to develop and implement internationalisation plans, and by better aligning current government incentives, policies and financial support mechanisms, the state could be of great help in assisting the higher education system to become more internationalised.

Table 2.4. A comparative advantage of internationalisation of higher education in Paraná

Internationalisation elements	Level of development and implementation in leading countries and institutions	Situation in Paraná
International dimension in the institutional mission.	The international dimension is clearly defined as part of the institutional mission.	An indirect mention to the international dimension is included in some institutional missions.
Internationalisation policy.	Clearly defined and publicised.	Exists in large institutions. Non-existent in medium and small institutions
Office of International Programmes (OIP).	Formal unit fully dedicated to support internationalisation. Adequately trained professional staff. Formal budget.	OIP exists in large institutions. OIP's leadership in charge of a political appointee (usually a faculty member), subject to change when a new university administration takes over. OIP non-existent (or in charge of a part-time employee) in medium and small institutions. Formal budget for OIP in large institutions and no specific budget in medium and small institutions.
Internationalisation of the curriculum.	Present in most of the academic programmes. Mechanism in place to include the international dimension when relevant in courses.	Only present in a few academic programmes. No formal mechanism established to include the international dimension in the review of the curriculum.
Outbound student mobility.	5-10 % of all domestic students participate in a study abroad programme.	Less than 0.5% of domestic students participate in a study abroad programme.
Inbound student mobility.	5-10 % of total enrolment composed of international students (including degree-seeking and exchange students).	Less that 0.5% of total enrolment composed of international students in higher education institutions in Paraná.
Full command of a second language.	All students must demonstrate full command of a second language.	Policies in place in some institutions, although not enforced. Optional remedial, fee-based courses offered to interested students.

Table 2.4. A comparative advantage of internationalisation of higher education in Paraná (continued)

International academic staff mobility.	In-bound and out-bound mobility of academic staff. Sabbatical programmes aimed at international experiences. Policies to attract foreign teaching academic staff.	Limited number of academic staff being supported for out-bound mobility, mostly at large institutions. Insignificant number of foreign academic staff in regular teaching activities. UNILA aims to recruit 250 faculty from Latin America.
Subjects being taught in a foreign language.	Availability of some regular subjects being taught in a foreign language.	In general, no regular courses being taught in a foreign language. However, UNILA aims to give courses also in Spanish.
International partnerships for the development and offering of dual/joint/sandwich degrees	Offering of degrees in conjunction with selected international partners. Strict internal quality assurance policies and regulations aimed at guaranteeing similar quality to regular domestic offerings.	Some programmes offered in conjunction with international partners. No formal quality assurance policy.

International examples of HEI's internationalisation strategies

International examples of a broader approach to internationalisation come, for example, from the University of Granada in Spain. While there is much scope for internationalisation in Andalusian universities and improvement in command of foreign languages, the University of Granada has taken encouraging steps to address the challenges. It has profiled itself as the leading Spanish university in international student mobility. Its international activities include not only mobility, but also projects that link with local employers and a permanent presence North Africa. The university has recognised that poor language competencies have a negative impact on regional development in Andalusia and the internationalisation of local businesses and has developed a strategy to improve the language competencies of students, graduates and teaching and administrative staff. Furthermore, it actively participates in language learning efforts sponsored by the Regional Government of Andalusia (see Box 2.16.).

Box 2.16. University of Granada and focus on internationalisation

The University of Granada is the leading university at Spanish and European level in student mobility, in terms of both incoming and outgoing students. In Spain, it is also the leading university in terms of number of students in international work placements (57), financed by the Erasmus Programme. It is a founding member of the Coimbra Group of universities, which pride themselves of their historical strong impact on locally and regional development.

Outgoing student mobility is considered important for students, as it provides them capacity-building opportunity to acquire language, intercultural and interpersonal competencies as well as initiative and personal autonomy. The strong international activity has contributed to the University of Granada having the highest percentage of any university in Spain of graduates working abroad: 3.6% of graduates (in 2006). Incoming mobility is seen as vital for the internationalisation of the university impacting the entire institution. International students are integrated in the university and also local activities, such as voluntary work programmes organised by the Science Museum and the Development Co-operation Centre (Cicode). During the welcome week at the beginning of each semester for all incoming international students, they are appointed as "Ambassadors of Granada" by the City Mayor, recognising the importance the impact of their stay in Granada may have for the image of the city in their institutions, cities and countries of origin.

The University of Granada participates in 40 European projects on different programmes. It runs four Erasmus Mundus Master's programmes that have regional impact, for example, EuroPublicHealth, which is co-ordinated jointly by the university and the Andalusian School for Public Health, a regional institution devoted to continuing training programme for health professionals and administrators.

Two projects with Latin America involve local and regional stakeholders and have potential for business development. The GERM project aims to compare university-business links and knowledge transfer in Europe and Latin America, identify good practice and finally strengthen these links. It involves local companies and Chambers of Commerce in the participating countries. The VertebrALCUE Project (Alfa III 2008-11) aims to contribute to the development of regional integration of Latin American Higher Education Systems and the implementation of the EU-LAC Common Area of Higher Education by exploring and strengthening academic co-operation through the design and implementation of liaison structures and supporting closer co-operation among universities, enterprises, local government and society, thus contributing to local development and social cohesion.

Box 2.16. University of Granada and focus on internationalisation (continued)

The university has also pioneered initiatives related to language learning. It participates in the Plurilingualism Plan of the Regional Government of Andalusia, which has introduced bilingual streams in an increasing number of primary and secondary schools in the region over the past ten years. The university sends both final year language students and international students to local schools in Granada and also smaller towns. The university has also developed a syllabus and pilot scheme for the teaching of Arabic as a foreign language in secondary schools in co-operation with the Regional Ministry for Education. The scheme, currently piloted in four schools in Andalusia, is of interest both to the large Arabic-speaking immigrant community and to other students interested in widening their language options. Finally, the Confucius Institute was opened by the university in co-operation with the University of Beijing and Hanban, the Chinese language institute, in 2008. Apart from offering numerous classes and other cultural activities to the population of Granada in general, this institute is about to set up classes in Motril, on the coast of the province and possibly also in other towns in the province. Initial contact has been made with the regional ministry to study the possibility of setting up a pilot scheme similar to that for Arabic for Chinese.

In Australia, the tertiary education sector accounts for over 5% of the state of Victoria's GDP and educational services are Victoria's strongest export, worth more than AUD 5.4 billion (Australian dollar), surpassing tourism and automotive sectors. The universities in Victoria have developed sever "global citizen initiatives" include "Monash passport" and RMIT University's "Global passport" that enables students to combine degree programmes with international exchanges, leadership programmes, work training programmes and volunteer and research opportunities. Swinburne University of Technology is reformulating its programmes grouping a professional major with a minor subject through its *Curriculum Framework Project*, while Victoria University has developed a Graduate Capabilities Statement which defines the attributes required to be "career ready, work ready and future ready". A common thread to all these initiatives is the focus on broadening the curriculum to develop additional skills and understanding either in Australia or abroad to enable students to "*excel in an open world economy*" (RMIT Global Passport). They also include a strong focus on employability via the experiential learning and the acquisition of soft skills, which employer groups most regularly identify as vital (see Table 2.5).

Table 2.5. Global citizen initiatives

Initiative	Main Features
Melbourne Model, University of Melbourne	Six broad-based undergraduate degrees with key features: disciplinary depth, breadth studies, knowledge transfer and capstone experience. Together with increased prospects for internships, study abroad and participation in industry projects, the degrees offer the chance to explore a range of interests before committing to a particular career path. *http://www.futurestudents.unimelb.edu.au/about/melbournemodel.html*
Monash Passport, Monash University	Combines degree programmes with international exchanges, leadership programmes, work training programmes and volunteer and research opportunities as a grounding for careers. *http://www.monash.edu.au/education/passport/*
Global Passport, RMIT University	International education and industry networks provide a wide range of opportunities for students to enhance their education or research experience – at the university's campuses in Melbourne and Vietnam; with partner institutions in Singapore, Malaysia and China and through education and industry links throughout the world www.rmit.edu.au/globalpassport.
Graduate Capabilities Statement, Victoria University	Graduate capabilities transcend technical skills and curriculum content and enable students and graduates to be work, career and future ready. On graduation, students will receive a Victoria University Graduate Capabilities statement as part of the Graduation Statement. *http://wcf.vu.edu.au/GovernancePolicy/PDF/POA050510000.PDF*
Curriculum Framework Project, Swinburne University of Technology	Model for Professional Learning which emphasises real world learning experiences within a supportive environment, integrated with skills development in order to prepare graduates to make the transition to professional practice. www.swin.edu.au/hed/framework/

Funding

One of the most effective mechanisms for co-ordinating the higher education system is the funding model. Due to the fragmentation of the higher education system in Paraná, there are specific challenges that the state government needs to face.

For the state university system, a performance-based allocation model would be useful in order to introduce a mix of performance-based allocation elements linked to both policy objectives and to institutional performance as a lever to increase efficiency and improve accountability. Performance-based funding encourages greater transparency in how resources are utilised by directly relating inputs to outputs. For example, output-based funding would provide the state government with the means to ensure that the required institutional behaviour is encouraged: *e.g.* courses and programmes aligned with regional needs or the education of an appropriate number of graduates in a particular discipline. The success of this system requires detailed and transparent data on costs of the university operations and

greater accountability of the universities in Paraná. The funding mechanism could also encourage a greater degree of institutional innovation and specialisation.

It would also be useful to consider whether incentives are needed to mobilise universities for regional engagement. This element could be integrated in the funding system through the launch of a competitive funding model for programmes that are needed in Paraná and its labour market. Competitive funds can fulfil many objectives including the improvement of quality, relevance and efficiency of the universities. Experience in OECD countries shows that a variety of funding mechanisms can be used to provide incentives for regional engagement of higher education institutions, for example:

- Formulae for block grant funding could include higher weights for enrolment from special populations such as students from LSE and/or immigrant backgrounds or for enrolments in academic programmes related to regional labour market needs.
- Policies governing financial aid to students can provide higher amounts for in-region students and special populations.
- Eligibility for special or "categorical" funding could be contingent on evidence of regional engagement and focus.
- Requirements that institutions collaborate in order to obtain funding. This could provide incentives for higher education institutions to facilitate mobility of students (credit transfer within the region) and share programmes and other resources in efforts to serve the region.
- Special funding to provide matched funding obtained by higher education institutions from contracts with regional employers for education and training services.

System steering and quality

A key issue impeding human capital development in Paraná is the fragmented governance architecture and the absence of a region-wide co-ordinating structure and mechanisms to articulate a long-term vision and implement an integrated development strategy for a wide range of different types of educational institutions in the public and private sector, which is facing considerable quality challenges. Transparent pathways for students through the education system are necessary. This involves the development of stronger credit recognition schemes, course and programme articulation agreements, clear and enforceable policies related to credit transfer and increased support for joint and collaborative programmes.

The efforts aimed at improving the quality of higher education in Paraná have been driven by regulations and policies established at the national level. The Brazilian quality assurance framework is complex as result of the diverse higher education systems in which complementary, interlinked and sometimes conflicting roles are assumed by a variety of federal and state agencies.

Institutional evaluation

The National Institute of Educational Studies and Research (INEP) has the leading role in implementing an overall institutional evaluation with the objective of improving the quality of higher education, according to the 2004 law which established the National Higher Education Evaluation System

The Institutional Evaluation has two components: a self-evaluation which is co-ordinated by an *ad hoc* Internal Evaluation Commission (*Comissão de Avaliação Interna*, CPA) established at each institution based on a series of guidelines developed by the National Committee for Evaluating Higher Education (CONAES); and an external evaluation which is conducted by specific peer review committees assembled by National Institute of Educational Studies and Research (INEP), which use a questionnaire composed of 41 indicators covering ten dimensions of analysis: mission and institutional development plan, policies for teaching, research and public service, institutional social responsibility, communication with the community, human resources policies, organisation and institutional management, physical infrastructure, planning and evaluation, student policies, and financial sustainability.

Introducing a new undergraduate programme and evaluation

To initiate the process of offering new academic programmes, institutions are subject to a variety of oversight processes conducted by various agencies, including *credenciamento* (government overall institutional approval), *autorização* (initial government authorisation granted to the institution permitting it to offer one specific academic programme), *reconhecimento* (government final authorisation to grant degrees once an academic programme, which already received its initial authorisation, has opened and has students who have almost completed their academic workloads), and *acreditação* (external review of academic programs).

When launching a new undergraduate programme, a higher education institution must obtain initial authorisation from the appropriate government

authority verifying that a series of requirements has been fulfilled. These relate to programme's pedagogical organisation, academic staff and physical infrastructure. Three years after authorisation has been granted and the programme has been in operation, a three-member peer review committee, appointed by either the Parana State Council for Education (CEE) or the National Council for Education (CNE), verifies the quality of the programme. Over the course of a two-day visit, the team verifies that all required elements of the programme are in place. This process includes consultation and dialogue with students and faculty members. Based on this review, the team produces a report with a recommendation, and which serves as the basis for the final authorisation of CNE/CEE. After the three-year review, a similar review is supposed to be carried out every five years. In theory, under this mechanism, higher education institutions can lose their status, or can be forced to close academic programmes if their quality is low.

In addition, the Ministry of Education evaluates undergraduate programmes through the *Exame Nacional de Desempenho de Estudantes* (ENADE), a national exam which assigns grades on a 1-to-5 scale, based on a written exam taken by first-year and last-year students and on the quality of faculty, facilities etc. (INEP 2010*)*. The national average for all higher education institution is 2.9, compared to 2.5 in Parana. The weaker performance is attributed to the municipal institutions (1.87) and private institutions (2.2). The two federal institutions have the grade of 3.1, which is 8.7% higher than the national average, while 17 state institutions score around the national average. According to ENADE grading, the quality of the undergraduate education in Paraná corresponds to the national average, with public sector scoring above average grades, whereas the for-profit private segment, which accounts for 52% of the total student enrolment, falls 12% below the national average for that segment.

Initiation of new graduate programmes

The initiation of new graduate programmes follows a rigorous and selective authorisation, recognition and renewal process handled by CAPES (*Coordenação de Aperfeiçoamento de Pessoal do Ensino Superior*) of the Ministry of Education. The process includes the following steps: *i*) the scientific committee of CAPES appoints a peer review team that conducts the initial visit, at the invitation of the higher education institution; *ii*) the team makes a decision about the authorisation and recognition regarding all graduate programmes; and *iii*) every three years a similar CAPES committee conducts a programme by programme review for the renewal of authorisation and recognition.[8]

The number of scholarships available to students of a particular institution is related to the evaluation received from CAPES. This also applies to faculty applying for grants, such as research grants and support for travel abroad for sabbaticals and conferences. As a consequence, all higher education institutions in Brazil work hard to obtain a good performance in the peer-review evaluation and focus on publications in international journals.

Based on the current quality evaluation system, the Paraná's best-ranked institution barely meeting the national average, and none of programmes reaching the highest grade.[9] Furthermore, only a few private schools have developed graduate programmes at a quality level to be recognised by the Ministry of Education.

How to reform the quality assurance system

The quality framework in Brazil and Paraná requires significant improvement in order to support an internationally competitive higher education system. The current higher education quality assurance framework represents a Type I traditional quality assurance system (see Table 2.5), which emphasises quality control, mostly at the initial stages of the offering of academic programmes. The quality control system is implemented by a central government agency. There is evidence that the current system lacks flexibility, is complicated and fails to foster a culture of institutional change.

The focus of the current quality initiatives in Paraná's higher education institutions – based on the regulations and guidelines defined by central agencies – emphasises proxies and indicators based on inputs (number of students per teacher, books per discipline, students per computer, publications per faculty member etc.) and on internal analysis. This institution-centric and input-based approach has limited focus on the analysis of learning outcomes and institutional impact. Furthermore, the programme review and approval process gives significantly more weight to national considerations than to the unique needs of the region. The most frequently heard concern about the programme approval process was the long delay in the process for approval of new academic programmes, which inhibits the responsiveness of higher education institutions to changing regional needs.

The development of the quality assurance system is key to helping higher education institutions in Paraná improve their teaching, research and public service functions in order to become an internationally competitive higher education system. If the state wishes to become a global player, significant efforts must be made to improve the quality of higher education

institutions and their education provision using as a reference the highest international benchmarks, and moving beyond nationally defined quality benchmarks. It is also important to emphasise the need for flexibility and diversity in the higher education system.[10] Finally, the quality assurance system should place greater importance to the performance of graduates, and on the information provided by the employers. By doing this, higher education institutions would benefit from input for their academic programmes, and from strengthened ties with graduates, employers and the community at large.

It is recommended for Paraná to explore ways to develop a roadmap that will guide the transition to a mature quality assurance system. Paraná could also explore the feasibility of establishing a state-wide independent quality assurance organisation or agency to which all higher education institutions in the state could be invited to participate on a voluntary basis. Such an independent agency could establish accreditation criteria competitive at the international level. At the initial stage, voluntary involvement could be supported with incentives offered to those institutions willing to participate. This should be supported by professional training within the higher education community and external stakeholders such as employers, parents of potential and current students and alumni.[11] By engaging key stakeholders in the process and by linking efforts more concretely with outcomes, incentives and institutional change, this will help higher education institutions take more "ownership" of their own institutional quality assurance systems as a tool for improving their institutional effectiveness rather than a mere requisite imposed by government agencies.

Furthermore, the experience of other OECD countries suggests that criteria emphasising regional engagement and responsiveness can be included in the programme review and approval. In the case of Paraná, these regional criteria could include:

- Data documenting the specific gaps in access and opportunity for the population and important sub-groups (*e.g.* students from low socio-economic background) and relevant regional labour market needs and potential future needs arising from regional economic development plans.
- Evidence of the engagement of regional stakeholders (employers, community representatives and representatives of under-served population groups) in programme planning and design.
- Emphasis on regional engagement (*e.g.* internships, community service, student research on regional issues) within the curricula and student experience.

Table 2.6. Typology of tertiary education quality frameworks

Variable/ type	Type 1: Traditional	Type 11: Transitional	Type 111: Mature	Brazil and Paraná
Approach for quality	Quality Control (QC).	Quality Assurance (QA).	Quality Enhancement (QE).	Initial work in QA, and still challenges in QC.
National efforts	Focus on procedures to control/impose quality measures.	Procedures accompanied by incentives, training and monitoring.	Accreditation based on adoption of QA practices.	Still a strong emphasis on procedures and check-lists.
Level of institutional intervention	Institution-wide.	At the level of academic offerings.	Institutional and academic offerings.	Major emphasis on institution-wide intervention with initial work on accreditation of academic offerings, especially at the level of graduate programmes.
Timing of intervention	Ex ante facto.	Ex post facto.	Both.	Mostly ex-ante-facto with emphasis in the initial stage of offering of academic programmes.
Dominant evaluation approach	Educational inputs. Emphasis on institutional indicators.	Educational outcomes and processes. Emphasis on learning outcomes and institutional effectiveness.	Both.	Major emphasis in educational inputs, and some attention to outcomes through checklists defined by a central agency.
Participatory approach	Mandatory participation.	Voluntary participation.	Both.	Mandatory participation.
Applicability by institution type	Either private OR public educational institutions. Differential treatment.	Private AND public educational institutions. Trends towards equal treatment.	Educational institutions and specialised accrediting agencies. Equal treatment.	Applicable to both although with differential enforcement and regulations.
Applicability by institutional level	Universities.	Universities and some non-university institutions.	All levels of the tertiary education system.	All levels of the tertiary education system.
Level of government participation	Central. Government Agency.	Semi-autonomous.	Independent. Non-governmental entity.	Central.
Level of student participation	QA system application.	QA system design.	Both	QA system application.

Source: Adapted from Marmolejo, F. (2005), "Internacionalización de la Educación Superior: Algunas Reflexiones", Educación Global, No. 9, AMPEI, Guadalajara.

Conclusion and recommendations

Paraná is well endowed with higher education institutions, especially those belonging to the state of Paraná. A higher than average share of the population has university education. Innovative initiatives are underway to widen access to higher education, to improve relevance of education and internationalisation. However, there is a need to widen access to higher education, to improve alignment of study programmes with the labour market needs and the overall quality of education and students learning outcomes and entrepreneurial skills. Higher education institutions' interactions with the labour market are limited, as elsewhere in Brazil. The progress in internationalisation is uneven across institutions. Finally, the current quality assurance system does not encourage institutions for institutional development.

The OECD review team recommends that the following measures are taken to promote human capital development in Paraná:

- The state government and higher education institutions and interested parties should work together to improve the data on labour market needs and trends. Higher education institutions should systematically monitor student progress as well as students' labour market outcomes and graduate destinations. The most effective region-wide graduate labour market systems are based on the collection of comprehensive labour market intelligence and on-line publication of the data in a single place. This improves students' ability to make rational choices about their studies, helps graduates and employers to come together and helps students to move to employment. Effective labour market systems use the data strategically to identify regional and institutional priorities and help higher education institutions respond to the data in terms of course provision and the supply of employer-specified skills.

- The state government should explore the feasibility of establishing a state-wide independent quality assurance organisation or agency to which all higher education institutions in the state could be invited to participate on a voluntary basis. Such an independent agency could establish accreditation criteria that is competitive at the international level. At the initial stage, voluntary involvement could be supported with incentives offered to those institutions willing to participate.

- Higher education institutions and federal and state governments should continue and expand efforts to increase the enrolment and success of students from lower socio-economic backgrounds. These efforts should build upon international best practices of effective academic, social and financial support for students, long-term collaboration with secondary

education institutions to improve students' learning outcomes and raise their aspirations and adoption of more student-centred learning methods. Student aid programmes at the state level should be reviewed in order to ease the financial burden of attending higher education and make loans more available to students.

- Higher education institutions should continue and strengthen their efforts to improve completion rates. The efforts of several higher education institutions in the region have shown genuine promise, and these efforts should be supported, expanded, and disseminated as models to other institutions.

- Higher education institutions should focus on the employability and entrepreneurial skills of graduates; providing students with the skills and competencies needed in the globalised knowledge economy. Stronger alignment of education provision with regional needs, closer university-industry collaboration, work-based and problem-based learning opportunities and programmes to develop transferable and entrepreneurship skills would improve employment outcomes of students. Similarly, efforts in language learning could help the region in its internationalisation efforts. All degree programmes should include also learning English.

- The state government and higher education institutions should take steps to significantly expand higher education opportunities for working age adults. These steps should create clear and transparent pathways to advanced education for adults, including the ability to attend multiple institutions, obtain short-term education and training that can later be applied to degrees, and re-skilling and up-skilling courses and programmes designed around the particular needs and interests of adults who often combine work and study. The state government could consider establishing an agency to help recognise prior informal and non-formal learning.

- The state and federal governments and employers should recognise the increasing relevance and importance of education in technical employment fields. There is evidence that needs and opportunities are growing in these fields, but that these trends are under-recognised in Paraná and within higher education.

Notes

1. Data on drop-out rates are not readily available, but information from the 2008 Higher Education Census can be used to compute the ratio of total enrolment to annual admissions. This can be viewed as the average duration of the course, since it is measured in number of years. It can be biased by the different mixes of courses with different durations across types of institutions, and by the fact the students who do not pay tuition have fewer incentives to graduate in the required minimum number of semesters, it provides a useful indicator. The ratio for 2008 Paraná was 2.6 for private institutions, compared to 3.9 in public institutions, indicating that drop-out rates are higher in the private sector.

2. Each institution can apply additional restrictions, usually relating the total number of hours involved in internships with the share of credit-hours accomplished by the student.

3. *Instituto Euvaldo Lodi*, part the consortium of organisations representing the manufacturing sector in Brazil, has among its goals the skills development for the state. However, its work in this area is limited to managing a database of opportunities for internships that can be consulted by students. CIEE – *Centro para Integração Empresa Escola* is another institution involved in organising internships. An interview with their management revealed that there is no evaluation of companies' satisfaction on the interns. CIEE does not engage in assessment of the outcomes of the internship. Furthermore, higher educational institutions themselves do not seem to have a tracking system.

4. PUCPR initiated the process with FIEP and was joined by other higher education institutions in 2009.

5. The legal profession is highly regulated by the *Ordem dos Advogados do Brasil* (the equivalent of the American BAR): the license to practice is provided through a comprehensive graduation exam, in which the approval rate is only around 20%. The high hurdle imposed by the BAR can signal a concern in protecting the territory from newcomers or the oversupply of lawyers.

6. As an example, see the list of courses offered at www.inspirar.com.br/cursosextensao.php.

7. The Open Course Ware is a platform, created at the MIT, which, with the financial support of the Universia network, has been extended to the Spanish and Latin American universities. It enables publication of teaching materials for the subjects imparted in each university. It is based on the "open content" concept, which gives free access to the published

content so that it may be used in different types of educational processes. Virtual Learning Platforms are common access points via which the entire university community has at its disposal useful tools for e-teaching, which makes it possible to complement classroom teaching and provide distance learning.

8. Programmes are evaluated on a 2-to-7 scale, based on the quantity and quality of publications, volume and quality of research, number of students graduated etc. Any programme receiving a grade 3 or higher is recommended by the Ministry (CAPES 2010). About 30-40% of proposed graduate programmes are rejected, whereas in the case of undergraduate programmes, there has never been a recommendation to withhold recognition of a programme in an accredited higher education institution.

9. According to the latest available evaluation for the period 2004-06, the State University of Maringá is the best-ranked institution in Paraná, with an average grade of 4.23, which matches the national average. This university features programmes with grade 6, which is the highest grade achieved in Paraná. In spite of this performance, the university also has 24 programmes with the lowest grade (3). The second highest is Federal University of Paraná, which has the largest number of programmes. The average grade for this university is 4, with six programmes with grade 6, and 19 with the lowest grade. The State University of Londrina's has the third highest grade, 3.75 with none of the programmes with grade 6.

10. Pursuing quality by utilising international benchmarks does not mean that characteristics of one single type of institution from abroad should be utilised as a reference or that accreditation offered by accrediting agencies from abroad should be chosen as the sole proxy of quality based on international standards. It does not mean that all institutions should aspire to become top level international research oriented universities, but that in each of the subsectors, the institutions should establish ambitious but achievable goals not only meeting with national benchmarks and requirements but, more importantly, also defining them in light of international standards and practices, while highly valuing the diversity of institutions and institutional missions.

11. Similar programmes have been established in Mexican states, Chile, the United States and Canada.

Annex 2.1. Accredited graduate courses

Table A.2.1. Graduate courses accredited by the Ministry of Education in Paraná, 2008

Institution	Number of programmes	Subjects	Average Grade	Minimum Grade (No.)	Maximum Grade (No.)
Federal University of Paraná (UFPR)	55 M 35 D	Management, Accounting, Agronomy, Anthropology, Psychology, Medicine (3), Animal Sc (2), IT (2), Biology (6), Botanic, Political Sc, Food Sc, Social Sc, Economics, Education (2), Engineering (9), Literature, Physics, Geography, History, Math, Dentistry, Chemistry, Pharmacy (2), Nursing, Geology (3), Law, Architecture, Ecology, Physical Ed, Philosophy, Environment (4), Music	4.0	3 (19)	6 (4)
State University of Londrina (UEL)	32 M 12 D 2 F	Management, Agronomy, Psychology, Medicine (7), Animal Sc, IT (2), Biology (2), Food Sc, Social Sc, Communications, Law, Economics, Education (2), Physical Ed, Engineering (2), Literature (2), Physics, Geography, History, Math, Dentistry, Chemistry (2), Social Service	3.75	3 (18)	5 (7)
State University of Maringá (UEM)	27 M 16 D 1 F	Management, Agronomy (2), Psychology, Medicine, Animal Sc, IT, Biology, Food Sc, Social Sc, Economics, Education, Engineering (2), Literature, Physics, Geography, History, Math, Dentistry, Chemistry, Pharmacy, Nursing	4.23	3 (24)	6 (4)
State University of the West of Paraná (UNIOESTE)	16 M 2 D	Agronomy, Social Sc, Environment, Economics, Education, Engineering (4), Philosophy, Geography, History, Literature, Fishery, Social Sc, Animal Sc	3.3	3 (13)	4 (4)

Table A.2.1. Graduate courses accredited by the Ministry of Education in Paraná, 2008 (continued)

Institution	Number of programmes	Subjects	Average Grade	Minimum Grade (No.)	Maximum Grade (No.)
Catholic University of Paraná (PUC/PR)	14 M 8 D	Management, Animal Sc, Medicine (3), Law, Education, Engineering (2), Urban Planning, IT, Dentistry, Theology, Philosophy	3.2	3 (4)	5 (1)
State University of Ponta Grossa (UEPG)	11 M 2 D	Agronomy, Biology, Food Sc, Physics, Social Sc, Education, Engineering, Geography, Literature, Dentistry, Chemistry	3.3	3 (9)	4 (4)
Federal Technological University of Paraná (UTFPR)	9 M 2 D 2 F	Agronomy, IT, Urban Planning, Engineering (7), Social Sc	3.3	3 (9)	4 (4)
Tuiuti University of Paraná (UTP)	3 M 2 D	Communication, Education (2)	3.8	3 (1)	4 (4)
C U Positive (UNICENP)	4 M 1 D	Management, Industrial Biotech, Environment Management, Dentistry	3.3	3 (3)	4 (1 D)
Mid-West State University UNICENTRO)	5 M	Agronomy, Pharmacy, Forestry, Geography, Chemistry	3	3	3
Paranaense University (UNIPAR)	3 M	Biotech, Animal Sc, Law	3	3	3
University of Northern Paraná (UNOPAR)	2 M	Food Sc, Dentistry	3	3	3
University Centre of Curitiba (UNICURITIB)	1 M	Law	3	3	3
University Centre of Maringa (CEUMAR)	1 M	Law	3	3	3
CU Franciscan of Paraná (UNIFAE)	1 M	Economics	3	3	3

Table A.2.1. Graduate courses accredited by the Ministry of Education in Paraná, 2008 (continued

Institution	Number of programmes	Subjects	Average Grade	Minimum Grade (No.)	Maximum Grade (No.)
State Faculty of Law of Northern Pioneiro (FUNDINOPI)	1 M	Law	3	3	3
Evangelical Faculty of Parana (FEPAR)	1 M 1 D	Medicine	3	3	3
Ingá Faculty (UNINGÁ)	1 F	Dentistry	3	3	3
Integrate Faculty. of Brasil (UNIBRASIL)	1 M	Law	3	3	3
Little Prince Faculty (FPP)	1 M 1 D	Medicine	5	5	5
Latin American Institute of Dental Research and Education (ILAPEO)	1 F	Dentistry	3	3	3
Institute of Technology for Development (LACTEC)	1 F	Engineering	4	4	4

Source: CAPES (Coordenação de Aperfeiçoamento de Pessoal do Ensino Superior) (2010), Avaliação da pós-graduação, *www.capes.gov.br/avaliacao/avaliacao-da-pos-graduacao,* accessed 9 September 2010.

Note 1: M Master level course; D Doctoral level course,;F Further education course

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Chapter 3.
Research, development and innovation

The promotion of regional innovation is an important driver of long-term economic growth and competitiveness. This chapter examines the effectiveness of current innovation policies and practices in Paraná and the role of research and knowledge transfer conducted by higher education institutions. It examines the current knowledge transfer and exchange mechanisms and highlights good practice from other regions. Finally, the chapter concludes with specific recommendations to improve the regional innovation outcomes in Paraná.

Paraná has made considerable investments to build capacity in research, development and innovation (RDI). The impact of the current RDI policy is, however, constrained by a number of limitations. These include: i) the narrow focus of research on a limited number of fields, missing the commercial potential of a wider research scope; ii) limited industry participation in R&D expenditure; iii) a lack of a systematic university-industry collaboration; and v) fragmented support for small and medium-sized enterprises. As a result, the full capacity of universities and other higher education institutions has not been mobilised for innovation and new business generation.

There is a strong private sector push to encourage universities' collaboration with industry and to identify the key strategic fields for Parana's economic development. The key message is that the policy makers should capitalise on the active private sector to mobilise higher education for regional development and innovation. At the same time, innovation should be understood in broad terms in order to build on Paraná's unique assets and to address its key social challenges.

Introduction

Investments in RDI, human capital development and other intangible assets are the cornerstones of a modern economy. Research, development and innovation (RDI) contribute to socio-economic growth and the development of countries and regions. Regions that develop and effectively manage their knowledge assets perform better economically. Knowledge-based enterprises outperform those with less knowledge focus and individuals with more knowledge get better paid jobs. Innovation is a complex phenomenon, which requires the interplay between institutions and the interactive processes involved in the creation of knowledge, and in its diffusion and application to socio-economic challenges. The reform of the RDI system in Paraná is an essential element in the reform of higher education.

The State Government of Paraná has taken steps to build RDI capacity. There has also been an extensive private-sector driven strategy process to identify key strategic fields of Paraná under the auspices of Forum 2010. This chapter examines the following three dimensions to assess the effectiveness and coherence of innovation and R&D policies and practices in Paraná and the role that the universities' play in regional innovation system:

- Is the innovation system well connected and responsive to the needs of the region and its industrial structure?
- Do the universities support the regional innovation system in an optimal way? Are there gaps in delivery where performance could be improved?
- What lessons can be learnt from international experience?

3.1 RDI in Brazil

Brazil has a strong focus on research, development and innovation in its public policy agenda. In recent years, rapid progress has been made in knowledge generation and capacity building for RDI. Presently, Brazil produces half a million graduates and 10 000 PhDs a year, ten times more than two decades ago. Between 2002 and 2008 Brazil's share of the world's scientific papers rose from 1.7% to 2.7%, ranking 15th in global scientific publications and 25th in scientific citations. Brazil is a world leader in research on tropical medicine, bio-energy and plant biology. Brazilian scientists are increasingly collaborating with scientists abroad: 30% of scientific papers by Brazilians now have a foreign co-author.

Brazil has the biggest expenditure on R&D among Latin America countries. It spends about 1% of its fast-growing GDP on research, half the OECD average but almost double the average in the rest of Latin America.[1] Brazil also boasts 270 business incubators and start-ups, half of them focus on research and technology. In 2008, there were 6 000 firms that had RDI investments, valued at BRL 1.9 billion. Brazil is a world leader in agribusiness. It has the largest banking and financial sector in Latin America and a strong oil and gas market as well as aeronautics and aerospace industries.

However, measured by patenting activity, Brazil still has a low innovation rate in international comparison and there is scope for improvement.[2] The Federal Government of Brazil has taken steps to address some of the key constraints limiting innovation in Brazil, including the lack of highly qualified human resource and bureaucratic constraints among public universities to the high cost and risky nature of investing in innovation in Brazil.

Considerable changes have been made in the legal and funding framework for science and technology institutions (STIs). New legislation calling for the convergence of technological and industrial policies and for the enhancement of ties between industry and universities in carrying out R&D have helped Brazil's efforts to make innovation a policy priority.

The Innovation Law (*Lei da Inovação)*, (2004) has established new mechanisms to promote innovation in Brazil. It has created incentive for partnerships between universities, public research institutes and businesses aimed at increasing research, development and innovation (RDI) activities and generating innovation. To boost innovation, the law allows the federal government to have minority participation in private companies. Furthermore, it allows the financial resources to be granted in the form of economic subsidies, financing or shareholding in order to develop innovative products and processes, and making technological solutions to problems concerning objectives of public interest. The law has enhanced Brazil's scientific and economic progress through the development of co-operative laboratories, joint projects, start-ups and skilled RDI workers. University researchers have the possibility to work in other science and technology institutes in joint projects while they continue to receive regular salaries. Researchers can also have unpaid leave if they become involved with a "start-up" company in order to further develop new technologies. In both cases, benefits from the commercialisation of intellectual property are expected to be shared among researchers, science and technology institutes, and private firms.

Another law, the *Lei do Bem* (2005), has created a series of fiscal incentives to promote corporate innovation-oriented physical and human capital investment in Brazil (MCT, 2007). It provides a set of fiscal incentives to promote RDI activities in businesses. The law authorises science and technology institutes to subsidise the salary costs of research staff with master's or doctoral degrees employed in technological innovation activities in companies based within Brazil.

Despite progress made in developing the legal and institutional tools to design and execute innovation-oriented development strategies, public and private sectors in Brazil continue to face difficulties in establishing priorities for investments and resource allocation.

The RDI system in Brazil continues to feature weaknesses. First, there is a low level of industry participation in RDI. The Ministry of Science and Technology estimates that 70% of R&D expenses are financed with public resources. Only 10% of RDI workers are employed in the private sector. Brazilian business sectors, particularly SMEs invest little in their own research. About 10% of the investments in RDI in Brazil are made by a small group of state-owned corporations and holdings, which have created their own research centres and operate mainly in telecommunications, oil, electric energy, mining, metallurgy, and aeronautics.

Second, there is an acknowledged disconnect between academia and industry and a strong focus in universities on knowledge generation rather than knowledge transfer. Approximately 80% of Brazilian researchers carry out their activities within public institutions. As a result, Brazil has consolidated strong scientific capabilities and produces a considerable volume of scientific publications. At the same time, however, technological performance measured by the number of patents suggests a different scenario. In 1980, the United States Patent and Trademark Office (USPTO) awarded 33 patents to Brazilian inventors. In 2000, this number rose to 113. Korea increased the number of patents registered from 30 in 1980 to 3 472 in 2000, an increase that places the country among the most important innovators. While Brazil's output in basic sciences reached a 2.02% share of internationally published articles in 2007, its share of the world's registered patents was only 0.06%, comparing poorly with countries such as South Korea (0.79%), Italy (1.31%), France (2.96%) and Japan (22.67%) (Rodríguez *et al.*, 2008). Brazil continues to lag behind other developing countries when it comes to converting scientific knowledge into practical results. One reason is the country's low level of investment in RDI. While Brazil dedicates only 0.98% of its Gross Domestic Product (GDP) to RDI, China invests 1.22%. As a result, Brazil remains behind its main global competitors: South Korea, China, India and Russia.

Thirdly, there is a lack of incentives for RDI activities in the private sector. In Europe, for example, between 2002 and 2004, an average of 35% of industrial companies received public funding to develop innovative activities. In Brazil, the proportion of industrial companies with industrial activities financed by the government is notably smaller (19% between 2003 and 2005). Brazilian manufacturing companies are relatively non-innovatory; their innovation costs are mainly related to the purchasing of machinery and equipment developed outside of Brazil, rather than R&D. In Brazil, industrial firms that have developed innovative activities invested about 0.7% of their net income in R&D activities in 2005, far less than the amount invested in countries like Germany, France and the Netherlands, where the proportion varies between 2.2% and 2.7% (MCT 2007). Brazilian entrepreneurs view innovation as high-tech development strategy restricted to large corporations.

National system of science, technology and innovation

The Brazilian national system of science, technology and innovation encompasses governmental departments, educational institutions and businesses. Key organisations include: The National Council for Scientific and Technological Development (*Conselho Nacional de Desenvolvimento Científico e Tecnológico*, CNPq), the National Agency for Financing Studies and Research (*Financiadora de Estudos e Projetos*, FINEP), the Co-ordination for the Improvement of Higher Education Personnel (*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*, CAPES) and the Brazilian Development Bank (BNDES).

The National Council for Scientific and Technological Development (*Conselho Nacional de Desenvolvimento Científico e Tecnológico*, CNPq), Formerly known as the National Research Council, CNPq is an agency of the Ministry of Science and Technology (MCT) that promotes scientific and technological research and training of human resources for research in the country. CNPq has also a programme of scholarships to university staff with a strong publication record (*Bolsa Produtividade*). Grant holders can have their income increased by up to 30%, depending on their ranking in the system.

The National Agency for Financing Studies and Research (*Financiadora de Estudos e Projetos*, FINEP) is a public institution also linked to the the Ministry of Science and Technology (MCT). It was created in 1967, to institutionalise a trust fund for research projects and programmes. Subsequently, FINEP replaced and expanded the role earlier played by the Brazilian Development Bank, and its fund for technical and scientific development. FINEP supports the economic and social development of

Brazil through the promotion of research, development and innovation in enterprises, universities, technological institutions, and public and private research centres. Examples include the support for the aircraft industry to become a major exporter of short haul aircraft and funding of numerous projects for the technological development of the Brazilian agricultural system, making it one of the most competitive in the world.

CAPES, the Co-ordination for the Improvement of Higher Education Personnel (*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*, CAPES) is the main Brazilian agency that finances and evaluates postgraduate studies, disseminates the results of scientific research, and promotes international scientific co-operation. CAPES facilities the expansion of postgraduate studies in the Brazilian states through: *i*) evaluation of postgraduate programmes; *ii*) access to and dissemination of scientific research; *iii*) investment in human resource development of RDI personnel in Brazil and abroad; and iv) promotion of international scientific co-operation. The CAPES evaluation system of university graduate programmes is a key instrument for the university community in search of a standard of academic excellence for national Master's and doctoral degrees. The evaluation results are used by the institutions as the basis for the formulation of policies aimed at promoting scholarship, graduate studies and co-operative RDI programmes.

The Brazilian Development Bank (BNDES) is a federal public company, linked to the Ministry of Development, Industry and Foreign Trade, the Ministerial do Desenvolvimento, Indústria e Comércio Exterior (MDICE). Its goal is to provide long-term financing to enhance Brazil's development and improve the competitiveness of the Brazilian economy. Support to innovation is a strategic priority of BNDES. From 2008 to 2010, the bank invested BRL 6 billion in technological innovation, providing support to all economic sectors. The BNDES has provided two innovation programmes: a technology fund FUNTEC, the Fundo Tecnológico, and a fund for small- and medium-sized enterprises, CRIATEC, the Fundo de Capital Semente. FUNTEC supports RDI initiatives in universities and technological institutions. CRIATEC, on the other hand, is a BRL 100 million fund focused on the capitalisation of seed money for innovative micro- and small-sized companies.

Brazilian funding for research, development and innovation comes from six main sources:

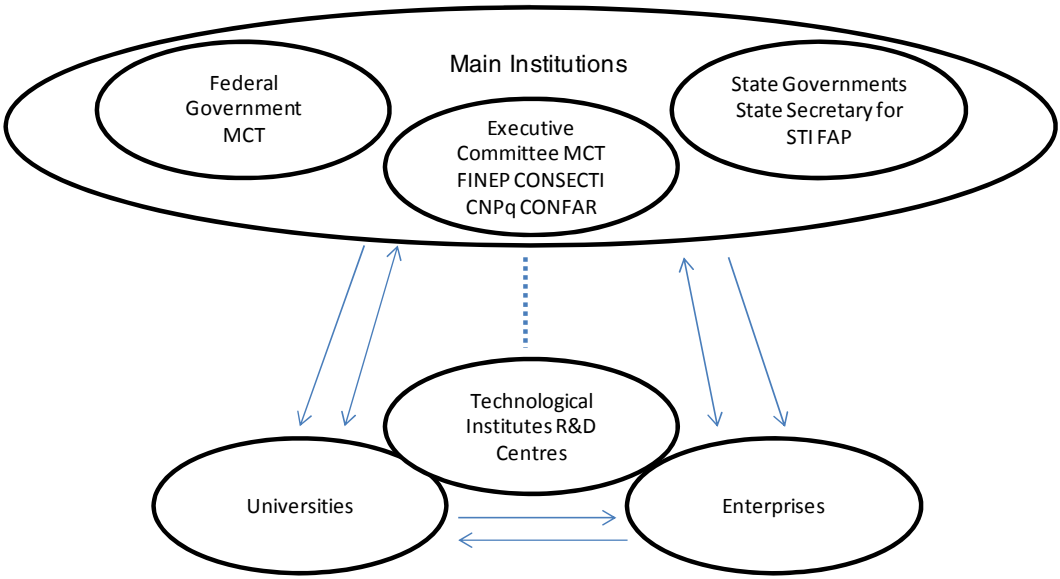
- Government (federal, state and municipal) sources such as the National Council for Scientific and Technological Development (CNPq) and the National Agency for Financing Studies and Research (FINEP), both a part of the Ministry of Science and Technology (MCT) at the federal

level, and the *Fundação de Amparo à Pesquisa do Estado de São Paulo* (FAPESP) in São Paulo, and Araucaria Foundation in Paraná.

- Indirect RDI funding through the budgets allocated to public and private universities, institutes and RDI centres.
- Direct funding of public RDI institutions, such as the Brazilian Enterprise for Agricultural and Livestock Research, the *Empresa Brasileira de Pesquisa Agropecuária* (EMBRAPA), whose source of revenue is via budgetary allocations by ministries and state secretaries as well as investment of part of the products and services sold.
- Tax incentives for industrial, commercial and private enterprises, usually for their own RDI centres, or via some fiscal benefit (tax exemption laws), such as the Informatics Law.
- Statutory funding of national private and non- profit associations and foundations such as the *Banco do Brasil Foundation,* typically provided via statutory mechanisms or donations by private individuals or companies.
- Funding by international organisations and multilateral and bilateral funding bodies, such as the World Bank, the Inter-American Development Bank, and UNESCO.

The key Brazilian organisations that promote and fund RDI are shown in Figure 3.1.

Figure 3.1. National system of science, technology and innovation



Source: Consolidação SNCTI, www.mct.gov.br/upd_blob/0203/203850.pdf.

3.2 Regional innovation systems in Brazil and Paraná

The relative autonomy of the Brazilian states allows state governments to play an important role in financing R&D and designing science and technology policies. However, the fragmented nature of the innovation system in Brazil makes it difficult for the government to co-ordinate actions among the various agencies and organisations tasked with implementing the country's innovation policies.

In Paraná, the Secretariat of State for Science, Technology and Higher Education (SETI) is responsible of co-ordinating research and higher education activities. In the area of research and innovation, several SETI initiatives are relevant for the objective of supporting the contribution of research to regional development. These include: Araucaria Foundation, TECPAR and NITPAR (see Box 3.1).

Box 3.1 SETI initiatives in support of RDI

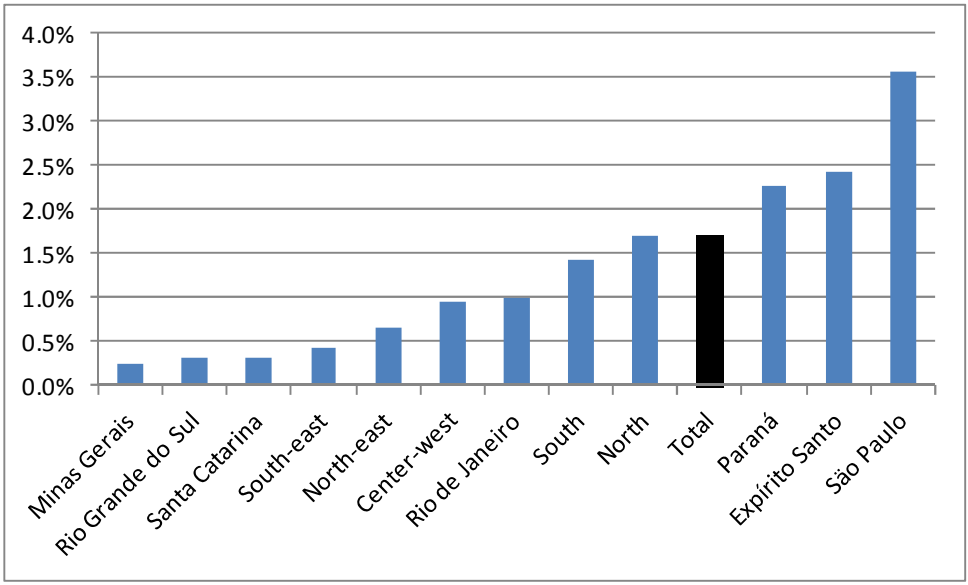
The Araucaria Foundation for Supporting Scientific and Technological Development of Paraná is financed from the Paraná Fund, which receives 2% of tax revenue to the state for scientific and technological development. Of this percentage, 30% goes to the foundation. The foundation has the following objectives: *i)* bolstering the research and training of human resources; *ii)* financially supporting projects and programmes or investing in units or centres; *iii)* developing and maintaining information systems; and *iv)* conducting studies on the development and scientific and technological innovations and their application. The foundation aligns its activities with the objectives of the State Policy for Scientific and Technological Development and, for instance, supports the Local Agents of Innovation Programme in collaboration with SEBRAE, the *Serviços de Apoio à Pequena Empresa* (SME agency), through which grants are awarded to recent university graduates who work in projects to create a demand pull in micro and small enterprises for RDI, bringing forward university-industry collaboration and research-based solutions to meet business needs.

TECPAR, originally created in 1940 as an agricultural research unit, is today a national reference centre contracting with higher education institutions and the private sector not only in Paraná, but also in other parts of the country. It comprises in particular a Biology and Technological Research Institute, a vaccine and antigen production unit, a fine chemistry laboratory, a vivarium and a biofactory. TECPAR engages in metrology, product testing, certification and quality control activities in many fields, while playing a leading role in major research projects in Paraná.

NITPAR, under the umbrella of the Secretariat of State for Science, Technology and Higher Education (SETI), is a network of Technological Information and Entrepreneurship Nucleus that has the purpose of intensifying the transfer of scientific and technological capacity within science and technology institutions to society as a whole.

In comparison to other Brazilian states, Paraná has invested significantly in science and technology. After São Paulo and Espírito Santo, Paraná is the third state in volume of spending in science and technology in 2008 (see Table 3.4 below and Annex 3.1).

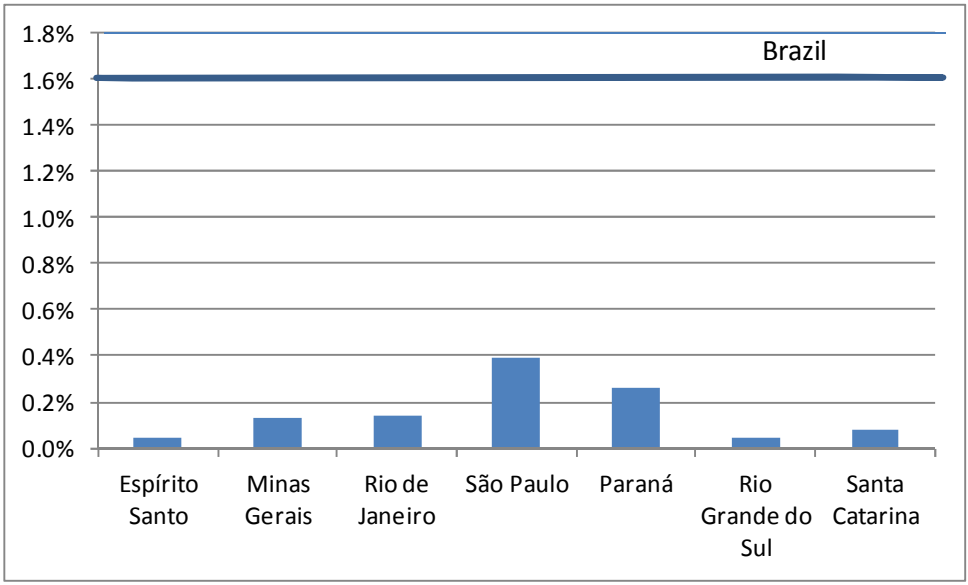
Figure 3.2. Percentage of state spending in science and technology related to the state public budget income, 2008



Source: Ministry of Science and Technology (*Minsitério da Ciência e Technologia – MCT)* www.mct.gov.br/index.php/content/view/740.html

São Paulo and Paraná are the Brazilian states that have the highest ratio of state spending in science and technology relative to their GDP in 2007 (Figure 3.3 and Annex 3.1). However, this ratio is smaller than Brazil as a whole, whose ratio includes the share of the federal government which tends concentrate in São Paulo, Brazil's richest state attracting the bulk of federal government RDI funding. São Paulo is leading the efforts in RDI and boasts the country's strongest universities. Its constitution guarantees the state research foundation, known as FAPESP, 1% of the state government's tax take, amounting to USD 450 million in 2010, which came on top of money from the federal government. This has allowed São Paulo to offer the money and facilities to attract foreign researchers.

Figure 3.3. Percentage of state spending in science and technology related to their gross domestic product, 2007



Source: MCT (Ministry of Science and Education) and IBGE, (Brazilian Institute of Geography and Statistics), (2010) *www.ibge.gov.br/english/.*

To address the challenge of a high degree of concentration of STI assets, the National Council of State Secretaries of Science, Technology and Innovation (CONSECTI) has developed partnerships among the states and the federal government in order to increase the resources for science and technology. The main actions to achieve this are: *i*) provision of state match funding in S&T from the federal level; *ii*) support for partnerships between public and private institutions; *iii*) the Innovation law of 2004, which allowed private enterprises to access public funding for R&D activities; *iv*) support for research in SMEs; *v*) the establishment by the Ministry of Science and Technology of the Brazilian System of Technology (CIBRATEC) in order to develop state and national networks for supporting R&D activities in the private business sector; and *vi*) expansion of the federal universities.

These measures and actions have been implemented to a different degree in all Brazilian states. In the state of Paraná the main actions included:

- Provision of 50% matching state-funding for federal investment in R&D.
- Implementation of the public-private partnership programme. Federation of Industries of the State of Paraná, FINEP (*Federação das Indústrias do Estado do* Paraná) established a partnership with the Federation of Industries (FIEP), the SME agency SEBRAE-PR, IBQP and two technological institutes, Lactec and Tecpar, in order to stimulate the development of innovation in SMEs in management, process and products through zero interest rate funding by FINEP.
- Progress in passing a state law of innovation. Currently, the proposed bill on innovation is in the state parliament, making the state of Paraná a late mover in this respect. Due to the absence of state law, the private sector has not been eligible to gain public resources for R&D.
- A partnership between the state of Paraná and Ministry of Science and Technology to develop a state wide network of technology as part of the Brazilian System of Technology (CIBRATEC) programme that aims to build state and national networks for supporting R&D activities in the private business sector.
- Expansion of the federal universities. In 2009, two new federal universities were established in Paraná: The International University of Latin America (UNILA) in Foz do Iguaçu and the Federal University of Southern Border (UFFS), a branch in Laranjeiras do Sul, which complement the two older federal universities: Federal University of Paraná (UFPR) and the Federal Technological University of Paraná (UTFPR).
- Increasing investment in S&T. Investments grew 48% between 2000 and 2008, increasing from 1.8% to 2.67% relative to the state public budget income.

While the policy framework and governance of the RDI system at the federal level in Brazil is relatively well established, and the capacity of institutions such as CNPq, FINEP and CAPES is substantial, the institutions supporting the governance of RDI at the state level are newer and weaker than their federal counterparts. The policy and governance constraints in Paraná include:

- A lack of a state level innovation law.
- Weak links for the development, implementation and monitoring of joint RDI initiatives between the state and federal funding bodies.

- The absence of a common framework for planning, funding, and accountability that results in the lack of purposeful co-ordination of RDI initiatives.
- Research institutions work within different organisational and administrative settings, are funded under different rules and lack standards and criteria for performance assessment and evaluation.
- Focus of universities in supply-driven delivery that does not respond well to the cross-disciplinary nature of knowledge generation in a modern economy.

The regional competitiveness approach argues that regional capacity can be developed by identifying the competitive advantages. Furthermore, public investments must be aligned with economic niches (Porter, 1998 and 1999). Table 3.4 shows the progress made in Paraná in terms of four essential elements for regional competitiveness in the global economy: strategy, governance, innovation and entrepreneurship. While progress has been made in identifying key strategic fields for regional development there is fragmentation in the regional innovation system and gaps in legislation, entrepreneurship support and innovation. There is a network of innovation actors and intermediary organisations with a lack of monitoring the rate of return of public investment. The challenge to innovation in Paraná is not the lack of resources or entrepreneurial capacity, but rather in making the different levels of government, university and business efforts combine in order to produce tangible products, services and processes.

Table 3.1. Paraná's competitiveness framework and universities' role

Essential ingredient	Target (ideal)	Paraná (actual)
Strategy	To identify the region's distinct competitive advantage. To align public and private actions necessary to seize it.	• A growing shared vision of key strategic fields through Forum Futuro 2010 under the leadership of the private sector (FIEP) and with key universities, but no representation from the State of Paraná.
Governance	To supply a framework to unite public, private and non-profit leaders as a collective guide and owner of the strategy.	• The state university and RDI system is steered SETI, bringing together human capital development and innovation, but organisational disconnect with workforce development. • Fragmented tertiary education system with a large number of private institutions, state universities and federal universities each under different governance structures. Separation between universities and vocational higher education.
Innovation	To link the region with new technologies and new ways of working and living that can transform the region's economic and social assets.	• State government's investments in RDI; Intermediary organisations and technology parks to boost university RDI and knowledge transfer in the region. • Limitations in evaluation culture and evidence base to monitor progress of a large number of small-scale programmes. • An absence of state innovation law; Dependency on public funding. • Universities focus on knowledge generation (research publications) rather than on knowledge transfer and have weak links with business and industry. • Limited focus on low-tech SME-based industry and non-technology fields.
Entrepreneurship	To provide a fertile climate in which new ideas can be transferred successfully into the market place.	• Universities' entrepreneurship activities and support structures are at early stages of development and focus on new business formation in high-tech fields.

Source: Adapted from Drabenstott, M. (2008), "Universities, Innovation and Regional Development: A View from the United States", *Higher Education Management and Policy*, Vol. 20, No. 2, OECD, pp. 43-55.

3.3 The RDI capacity of universities in Brazil and Paraná

Over the past 15 years, there has been a rapid expansion of postgraduate programmes in Brazilian universities. The number of master's students grew by about 70%, from 44 000 in 1996 to 74 412 in 2006, while the number of doctoral students more than doubled from 20 000 to 44 466. These increases have improved the geographical distribution of postgraduate courses,

resulting in a significant decrease in regional disparities in terms of opportunities for advanced human capital training" (Salmi and Fèvre, 2009).

However, despite this expansion of postgraduate enrolment in Brazil, its level still remains low, compared to other countries in Latin America; at only 2.6% in 2006, the proportion of postgraduate students in Brazil was half as high as that of Mexico and Colombia. The distribution of graduate programmes among key academic disciplines at the master's and PhD levels is better balanced than for undergraduate studies; at the master's level, humanities and social sciences account for than 28% of the total, while at the PhD level, 11% of all programmes, compared to 62% for undergraduate studies in public universities, (OECD, 2010a).

The regional distribution of the elite federal universities that undertake the bulk of RDI in Brazil is uneven across the country. While the large majority of states have only one federal university, Paraná has four, São Paulo and Pernambuco have three, Rio Grande do Sul and Rio de Janeiro have four and Minas Geraís has the largest concentration with eleven federal universities.

The large and diversified higher education sector in Paraná provides significant potential for boosting innovation. Considering that the federal universities undertake, the bulk of RDI in Brazil, Paraná is well-placed as its capacity has recently been strengthened through the expansion of the of Federal University of Paraná (UFPR) and Federal Technical University of Paraná (UTFPR), as well as the establishment of new universities in 2009: the International University of Latin America (UNILA) and the Federal University of Southern Border (UFFS).

However, according to the CAPES rating given to their university graduate programmes, only a few universities have a critical mass of postgraduate programmes (more than ten programmes) with a rating of 6 or higher. RDI production is concentrated in a small number of universities; the three universities in the State of São Paulo – USP, UNICAMP and UNESP – account for half of the total scientific production of the country.

From the perspective of RDI output, the Brazilian university sector can be divided into the four groups as indicated in Table 3.2. First, there is a small group of six top research universities that are productive and whose research quality is on the leading edge by international standards. Second, there is a group of 11 universities that are relatively productive and have RDI output in specific fields and disciplines. A third group consists of 24 universities that have limited RDI capacity, even though some of its members aspire to be recognised as research universities. Finally, the vast majority (over 2 230 out of an estimated 2 275 institutions) including most

universities in Paraná – other than UFPR – have virtually no capacity for RDI.

Table 3.2. The RDI capacity of Brazilian universities

Category	Number of postgraduate programmes highly rated by CAPES	Number of universities in category	Top three universities in category (Number of highly rated programmes)
Category 1: Top RDI productive universities with broad and diverse RDI capacity	Ten or more	6	Universidade de São Paulo, USP Universidade Federal do Rio de Janeiro, UFRJ Universidade Estadual de Campinas, UNICAMP
Category 2: Universities with some RDI targeted capacity	Three to nine	11	Universidade Federal de Viçosa, UFV Universidade de Brasília, UNB Universidade Federal de Paraná, UFPR
Category 3: Universities with limited RDI capacity	One or two	24	Universidade Estadual de Maringá, UEM Universidade Federal do Ceará, UFC Universidade Federal Fluminense, UFF
Category 4: Universities with virtually no RDI capacity	None	Over 2 230	

Source: Adapted from Salmi, J. and C. Fèvre (2009), *Tertiary Education and Lifelong Learning in Brazil*, Associação Nacional de Pós-Graduação e Pesquisa em Educação, (National Association of Post-Graduate and *www.anped11.uerj.br/internacionalizacao/Banco_mundial/tertiary_education_in_brazil_15_Jan_09.pdf*

Universities dominate the intellectual property and patent ownership in Brazil, producing 27% of registered patents, whereas in developed economies this share is about 3%. There is a strong regional concentration of patenting activity. When it comes to registered patents, the University of Campinas, in the state of São Paulo (UNICAMP), ranks third overall in Brazil, outpacing large companies such as oil producer Petrobras, appliance maker Multibrás, and EMBRAER, the aircraft maker. The biggest patent owners in Brazil include a long list of universities, headed by the Federal University of Minas Gerais (UFMG), the University of São Paulo and the Federal University of Rio de Janeiro.

In Brazil, most researchers are employed in the university sector, where 68.8% of all PhD holders in the country can be found, compared to only 8.3% in research centres and 5.9% in enterprises (9and Fèvre, 2007). The proportion of RDI workers employed in private enterprises has decreased in recent years. In 2000, 26% of all RDI workers were employed in private enterprises and 70% in universities, as opposed to less than 20% in private

enterprises and over 75% in universities by 2007. By contrast, in OECD countries, almost 70% of RDI workers are either directly employed or actively collaborating with counterparts in enterprises, and less than 25% are employed in the university sector.

Due to the legacy of the poor, albeit improving performance of its school system, Brazil and Paraná are short of established scientists, research groups and competent research group leaders. There are, however, a number of constraints in this area. While Brazil pays junior researchers well by international standards, the same does not apply at the top of the scale. Publicly funded universities have limited flexibility to offer additional funding for top scientists and cannot offer research-only contracts; all tenured academics must teach undergraduates. Heads of department cannot simply identify the best candidate and start negotiating; all permanent positions can be filled only by open competition that includes a public examination in Portuguese.

Despite the current constraints, there is scope at both federal and state level to develop talent attraction programmes to build capacity in RDI, particularly as research funding is being squeezed in Europe and North America. International examples include ICREA, a dedicated head-hunting and recruitment agency that attracts top researchers to Catalonia – whether of Catalan/Spanish origin or not. In 2010, there were about 250 ICREA researchers, who collectively attracted more than their costs in research funds from outside the region. ICREA researchers have higher than average publication rates than researchers in the region generally. ICREA researchers have also applied for 42 patents since 2004 and launched three start-up firms (see Box 3.2).

Box 3.2 The Catalan Institution for Research and Advanced Studies (ICREA)

The Catalan Institution for Research and Advanced Studies (ICREA) is a foundation supported by the Catalan Regional Government and guided by a Board of Trustees. It was established in 2001 to recruit top scientists for the Catalan R&D system in order to boost Catalonia's competitive position. Successful candidates must be capable of leading new research groups, strengthening existing groups, and setting new lines of research on the right track. ICREA has hired a total of 249 researchers in different areas of research: 31% in life and medical sciences, 28% in experimental sciences and mathematics, 11% in social sciences, 15% in humanities and 15% in technology.

ICREA brings to the Catalan innovation system top researchers who play an active role in the university in terms of research and teaching, either in direct classes or at a minimum through oversight of student research. The ICREA researchers collectively attract more than their costs in research funds from outside the region. ICREA researchers have higher average publication rates than researchers in Catalonia generally. ICREA researchers have also applied for 42 patents since 2004 and launched three start-up firms.

Source: ICREA (Institución Catalana de Investigación y Estudios Avanzados) (Catalan Institution for Research and Advanced Studies), *www.icrea.cat/web/home.aspx.*

3.4 Universities and knowledge transfer in Paraná

Public universities and the leading private higher education institution in Paraná, the Pontifical Catholic University of Paraná (PUCPR) are each responding in their own different ways to regional needs and developing their innovation activities with focus of IPR and science-driven activities. Most of the larger higher education institutions have established knowledge transfer offices and leading institutions also have active incubators. For example, the PUCPR has recently created a Technopark (6 000 m^2 at the initial stage but with a plan to expand up to 40 000 m^2). Furthermore, universities are increasingly drawing funding from external sources (including contract and fees of courses for companies). While there is limited robust data about the outcomes of these activities, the universities' knowledge transfer offices lack the economies of scale or scope to optimally commercialise faculty innovations. They could consider widening the

concept of knowledge transfer to long-term partnerships with industry, government and other partners in order to help support jobs, industry productivity and innovation in the region.

International examples also demonstrate how leading research-intensive universities are moving to a more holistic approach in knowledge exchange. For example, the University of California, Berkeley reformed its commercialisation infrastructure in 2004 to achieve a more holistic approach to industry collaboration in recognition that in many cases there is no need for a discussion over Intellectual Property (IP). The new office has seen a reduction in cultural and negotiation biases, an increase in industry and foundation funding as well as collaboration types and number, a reduction in barriers to giving donations to the university and a formation of greater numbers of contracts and strategic alliances (see Box 3.3).

Box 3.3 The University of California, Berkeley and knowledge exchange

The University of California Berkeley reformed its commercialisation infrastructure involved with industry contracting in 2004 to adopt a holistic approach to research commercialisation. It recognised that industry could approach the university from many different directions, some of which require contracts while others do not. By merging the activities of the Office of Technology Licensing and Industry Alliances Office into the Intellectual Property and Industry Research Alliances (IPIRA) office, Berkeley was able to streamline industry transactions and increase corporate sponsored research. IPIRA identified the following programmes:

- Philanthropy (no strings attached to gifts).
- Open collaboration model where firms undertake research alongside academics and students with an open dissemination framework.
- Industry Affiliates Programme where firms pool resources to fund common research around particular expertise.
- Corporate sponsored research (large and small) including the establishment of large scale cross-disciplinary university-industry research institutes where the results are taken up and commercialised by industry research, including through start-ups.
- Socially responsible Intellectual Property Rights management to promote widespread availability of technology and healthcare in developing countries.

Source: PACEC (Public & Corporate Economic Consultants) (2010), The Higher Education Knowledge Exchange System in the United States. A report to HEFCE by PACEC and the Centre for Business Research, University of Cambridge.

Furthermore, there is scope for inter-institutional collaboration in Paraná. Currently, collaborative mechanisms between the higher education institutions in Paraná remain limited. There is no mechanism of pooling knowledge and expertise of higher education institutions to deliver support to industry. In particular, small and medium-sized enterprises (SMEs) face barriers in accessing the knowledge and expertise within the higher education institutions. While the establishment of a joint office for higher education institutions is a challenging task, given the differences in governance and the large size of the state, modern technology can facilitate stronger collaboration in this domain.

In North East England, the Knowledge House is an initiative that provides an example of collaboration between universities using virtual and face-to-face collaboration. The Knowledge House was created in 1995 specifically to overcome the barriers in collaborating with the small and medium-sized enterprises (SMEs), and to increase the amount of technology transfer taking place between local firms and universities. The purpose was to create a structure that suited SMEs looking for help with a particular technical problem. Usually, the first barrier an SME faces in contacting a university about possible cooperation is the lack of knowledge of who to contact. The Knowledge House provided a single point of contact for all five universities in the North East England, plus the North East branch of the Open University in England. Over the years, the Knowledge House has evolved and developed and now serves all types of industry, ranging from multinationals to micro and small businesses. Each participating higher education institution has retained its own technology transfer office (see Box 3.4).

Box 3.4. Knowledge House: a collaborative network to support SMEs

Established in 1995 Knowledge House is a joint effort of the five universities in the North East of England (Durham, Newcastle, Northumbria, Sunderland and Teesside) along with the Open University in the North through universities regional association, *i.e.* the Universities for the North East (Unis4NE). It helps companies access university skills, expertise and specialist resources. It offers expert solutions, for developing ideas and solving problems through collaboration, consultancy, training and research. Knowledge House has a central headquarters and staff, which are placed at partner sites of the different universities. The network and its operations are supported by a web-based enquiry handling/project management and client relationship management system.

Box 3.4. Knowledge House: a collaborative network to support SMEs (continued)

The Knowledge House can be accessed via a central node, based at a Regional Technology Centre, or any of the five university nodes. The initial enquiry is then sent out to contact people at each of the five regional universities, inviting them to suggest academics that could address the identified need. Each university has a co-ordinator responsible for ensuring that the requests are disseminated to the correct contacts. Ideally, the Knowledge House is able to offer the SME a choice of academic consultants and can facilitate a meeting for the firm's managers to meet with and select the most appropriate person for their needs.

The Knowledge House has generated an income in excess of GBP 13 million for its universities from over 1 300 projects since 1996, with GBP 7.6 million of this coming in the last four years. The Knowledge House's profile has risen significantly over time, with more than half (60%) of all enquiries generated since 2003. In 2007, the Knowledge House generated GBP 4.7 million for the participating universities by delivering 364 completed projects from over 800 business enquiries. Business growth has averaged 25% since 2000.

In contrast to networks providing signposting services only, the Knowledge House offers a comprehensive service, stretching from the receipt and circulation of enquiries through project management and delivery to post completion evaluation. It is also playing its part in the integration and consolidation of the business support services in the North East through formal agreements and joint appointments with other non-university business support agencies such as the Business Links Service and the Regional Development Agency. The Knowledge House is also facilitating a culture change within the academia as an increasing number of higher education staff across the region's universities are becoming engaged with the Knowledge House activities.

Source: OECD (2007a), Higher Education and Regions: Globally Competitive, Locally Engaged, OECD, Paris; and Potts, G. (1998), "The HESIN Knowledge House: A Front Door to North East Universities" *Local Economy*, Vol. 13, No. 3, Routledge, London, pp. 267-271.

Currently, the priority is given to the knowledge generation rather than innovation to support local and regional development. There is, however, a growing understanding at the university leadership level that relevant research should include not only a curiosity-driven (basic) component without particular end use in mind, but also the use-inspired (applied) component.

There is an issue of securing sufficient funding for the RDI activities and infrastructure**.** The current levels of public expenditures on RDI in Brazil and in Paraná expressed in terms of the Gross Expenditure on Research and Development (GERD), as a percentage of the GDP, are low in international comparison. University research activities are underfunded both in terms of infrastructure and facilities, as well as, project funding. Furthermore, despite the action and initiative by the private sector actors in Paraná, the funding contribution of the private sector to RDI initiatives in Brazil and in Paraná is low by international standards.

While the new target of1.5% of GDP by 2015 is a step in the right direction, the restructuring of the RDI funding mechanisms in Brazil and Paraná is essential to the long term sustainability and effectiveness of the RDI system. The enhancement of project-based competitive mechanisms is an essential aspect of the reforms. In the long run, investments are needed in specialised infrastructure for universities, including labs and technological incubators.

Constraints to mobilise higher education for regional innovation

The RDI activities in higher education sector in Paraná face many constraints. With the exception of the federal and state universities, most of the other universities have less than 20% of their teaching staff qualified at the PhD level. Poor second language capacity among RDI workers limits their ability to co-operate with international partners. The overall research production, albeit increasing, remains low in international comparison. There is also a lack of well-defined research priorities in Paraná resulting in research that is weakly aligned with state and national objectives or needs. Furthermore, the narrow disciplinary orientation in science-based activities and a lack of multidisciplinary approach in the RDI initiatives of the universities of Paraná is a constraint to innovation.

There are also a set of system-level constraints linked with the quality assurance, funding and incentive systems. A lack of common evaluation procedures and performance indicators for research and the rigidities in university-industry contracts result in low productivity and inefficient use of resources. As in many other countries, academic prestige and career progress are based on academic publications and not on third mission activities. Public universities lack incentives for regional innovation and engagement. For example, in state universities, most expenditures related to salaries and benefits are defined by the state's central administration (SETI), leaving limited operational flexibility to administer the university budgets. Furthermore, personnel costs absorb most of the university regular budget (around 90%), leaving limited scope for innovation and third mission

activities. Research funds are granted to individuals or groups who manage these funds, leaving limited scope to use funds strategically.

As a result, the innovation activities in Paraná are mainly developed outside of the universities, while universities have played a role of consultants in these activities. This role is changing as universities are taking a more proactive role in innovation as a result of a cultural change within the universities and the increasing potential of human resources.

Transforming public universities into more independent and autonomous organisations, subject to public accountability and operating within a competitive environment for resources could bring greater benefits for the regional economy.

Alignment of RDI to regional needs: learning from international examples

The state innovation policy and the universities in Paraná have currently a focus on science-based innovation with limited attention on demand-driven incremental innovation needs of small and medium-sized enterprises in industry and services such as tourism. It is important for universities and the state-level co-ordinating bodies to recognise that R&D activities, especially the commercialisation and exploitation of intellectual property derived from university research, is only one part of the university-industry interaction. Interest in commercialisation emerges often when firms have built up their absorptive capacity through long-term interactions with universities. The policy implications of this suggest the need for greater support for less R&D intensive forms of interaction with universities.

While there is limited articulation of demand for university R&D in the SME-based economy, some incentives have been created to connect small and medium-sized enterprises with universities and other firms. For instance, the Secretariat of State for Science, Technology and Higher Education (SETI) through Araucaria Foundation supports the Local Agents of Innovation Programme in collaboration with the SME agency SEBRAE. This programme provides grants to university graduates to work in joint projects to encourage SMEs to engage in innovation activities. No information is available regarding the success of this programme.

Paraná's Local Agents of Innovation Programme resembles the US Small Business Innovation Programme (SBIR,) this is the largest US innovation partnership programme with a budget of USD 2.3 billion in 2009. This programme, which has been in place for more than 25 years, has benefited from a stable budget: 2.5% of Federal Agency's R&D budget has been set aside for small business awards. SBIR has focused on proof of

concept and prototypes and helped firms to bridge the "valley of death" and attract private capital or win public contracts.

Box 3.5. Small business innovation and technology transfer programmes in the US

In 1982, the United States passed the Small Business Innovation Research Act (SBIR) in order to facilitate the absorption of new technology by small and medium-sized enterprises (SMEs) and in 1992 it passed the Small Business Technology Transfer Research Act (STTR). The SBIR provides up to USD 850 000 in early stage R&D to small technology companies or to entrepreneurs who launch a company. The STTR programme provides up to a similar sum to small companies working in cooperation with academic researchers in public laboratories in order to explore the commercial feasibility of new ideas emerging from these institutions. The different federal departments that allocate R&D funds to private firms run both programmes. In 2007, all departments combined, SBIR was funded at USD 1.14 billion and STTR at USD 131 million. In order to qualify for SBIR grants, firms must have fewer than 500 employees and conduct R&D in the United States. In addition, the principal investigator must work at least half time in the proposing firm. The STTR grants have similar firm-size requirements, but the principal investigator may be employed at either the firm or the research institution. Also the SMEs have to be more than 50% owned by its managers and/or employees. This requirement has the benefit of concentrating funds in the early stages of technology development. SBIR and STTR have helped thousands of innovative firms to explore the benefits of academic research results by reducing the cost of exploration and conversion of scientific ideas into commercial products (Auerswald and Branscomb, 2003).

An evaluation of SBIR conducted in 2006 concluded that the SBIR programme is sound in concept and effective in practice and achieving most of its specific objectives. SBIR awards played a key role in the decision to pursue a research project and SBIR funding is often used to bring in academic consultants to partner with firms. The Advanced Technology Program (ATP) was created in 1990 to help US businesses commercialise technologies and refine manufacturing methods. Companies or consortia of companies propose research projects to National Institute of Standards and Technology (NIST) which selects the proposals on the basis of economic potential. Universities can take part in consortia and propose projects but cannot serve as project leaders. ATP is a demand-pull programme: the research priorities are set by industry and not by government, academia or public laboratories. Funding is not confined to only small and medium-sized companies, but large companies can also participate if they cover at least 60% of the costs of the project. ATP helps emerging companies to explore new technologies in partnership with academic or government researchers. In its 2001 report, the US National Research Council concluded that ATP is successful in commercialising early-stage technologies (Niosi, 2008).

Source: OECD (2010b), *Reviews of Higher Education in Regional and City Development; The Paso del Norte Region, Mexico and the United States*, OECD, Paris, *www.oecd.org/dataoecd/17/61/45820961.pdf.*

Another, relatively cost effective way to create a demand pull for innovation within small and medium-sized enterprises (SMEs) are innovation or knowledge vouchers which have been successfully used in many countries for in the Netherlands (see Box 3.6.). The Dutch example deserves attention due to their strong emphasis on knowledge transfer from a higher education institution.

Box 3.6. Knowledge Voucher Programme in the Netherlands

The aim of the Knowledge Voucher Programme is to encourage knowledge transfer from knowledge institutes, such as universities and universities of applied sciences, to small and medium-sized enterprises (SMEs) and to help SMEs to access and use the knowledge produced by knowledge institutes for the development of new products, processes and services. SMEs can use innovation vouchers to commission knowledge institutes to address appropriate research issues.

Vouchers are available in two sizes: small and large. A small voucher is worth EUR 2 500 and a large voucher is worth up to EUR 7 500. To use a large voucher, an SME must make a contribution of at least one third of the total project cost; the government will then contribute up to EUR 5 000.

Vouchers are available for two types of projects: knowledge transfer projects and patent applications. Large knowledge transfer vouchers may be bundled: up to ten enterprises may collectively use vouchers which have been awarded to them individually to cover the cost of a major knowledge transfer project.

Vouchers may be used for projects involving the transfer of knowledge from public knowledge institutes and various private knowledge institutes. A knowledge transfer project involves the transfer of knowledge that is new to the receiving SME. The knowledge is used by the enterprise to modernise a product, production process or service. All projects must benefit the Dutch economy. No individual enterprise is entitled to receive more than one small voucher for a knowledge transfer project at any time and more than one large voucher per year. The bundling of patent application vouchers is not permitted.

Source: Senter Novem, Agentschap NL, Ministry of the Dutch Ministry of the Economy, *www.senternovem.nl/innovatievouchers*.

To improve quality and attractiveness of local jobs, Paraná could also consider establishing a more robust programme to link the students, graduates and post-graduates with the local industry. The Knowledge Transfer Partnership Scheme in the United Kingdom has been running successfully (previously as Teaching Company Schemes) since the 1970s.

Knowledge Transfer Partnerships improve the competitiveness of the companies through introduction of some form of innovation or new technology, while an additional benefit is usually the recruitment of the postgraduate associate; around 75% of associates in projects lasting from one to three years are offered jobs in the company (see Box 3.7.).

Box 3.7. UK Knowledge Transfer Partnerships

The Knowledge Transfer Partnership programme in the United Kingdom was launched in the 1970s as the Teaching Company Scheme, and was designed specifically to foster close collaborative partnerships between universities and companies with an explicit focus on the transfer of knowledge into company practice rather than supporting research in universities. The main focus is on improving the competitiveness of the industrial partner, through the work of post-graduate "associate" working in the company with supervision from the academic partner.

The scheme is partly funded by the companies involved and partly by a public organisation such as the Technology Strategy Board or a Research Council, with more advantageous terms available for small and medium-sized enterprises (SMEs). Typically an SME would pay around GBP 20 000 per year for involvement. The projects are usually 2 years in duration and the postgraduate associate is employed to work in the company during this period on a pre-defined project. The associate is paid a salary and in some cases is registered for a higher degree (usually devoting 10% of their working time to professional development), and forms the linkage between the company and the supervising academic in a university or research organisation. The academic partner is compensated for some of the time of the supervisor and for university overheads (KTP, 2010).

The primary outcome of the project is usually the implementation of some form of innovation or technology in the company, although an additional benefit is usually the recruitment of the associate and around 75% of associates in projects lasting 1-3 years are offered jobs in the company. The 2008/09 annual report for the scheme reported 977 active projects and estimated the benefits to UK business would be over 6 500 staff trained, 1 119 new jobs created and an increase in pre-tax *profits of GBP 126 million (TSB, 2009).*

Source: OECD (2010b), Higher Education in Regional and City Development: The State of Victoria, Australia, OECD, Paris.

Paraná's well-developed industry associations, such as FIEP, have taken steps to mobilise higher education to support SME development. More systematic, long term programmes could be used, for example, to activate university staff and students to act as trainers and developers and

providing students authentic work-based learning experiences. In North Carolina, US, small business development brings long-term counselling and training courses for small business owners throughout the state by using university business faculty and students as coaches. This innovative programme combines the needs of the small and medium-sized enterprises with the needs of the universities to provide systematic and well tutored work-based learning experience to students (see Box 3.8.).

Box 3.8. Small business development in North Carolina

In North Carolina, US, the federally funded small business assistance programme is a University of North Carolina system-wide programme managed by NC State. Its network of 17 Small Business Development and Technology Centres is based mostly at business schools in other public colleges across the state, providing training courses and counselling for small business owners.

The small business centres are focused on special expertise in technology assistance, in helping small business find local sources of capital and in providing lengthy (20 to 30 hours) and intensive one-on-one counselling programmes for small business owners. The programme is able to offer intensive consulting services because it relies on faculty and business students, about 650 a year. They provide valuable service and the experience adds value to their education. The programme counts 110 000 counselling clients and 85 000 attendees at training programmes since 1984, with the clients creating 25 000 jobs and growing sales and jobs at more than three times the state average. Separate training programmes are in place to help small investors in the state to understand how to set up, operate and succeed with local "angel capital "networks and to train small business owners how to find investors, understand their expectations and meet their needs.

Source: Shaffer, D.F. and D.J. Wright (2010), A New Paradigm for Economic Development, in Higher education, The Nelson A Rockefeller Institute of Government, March 2010.

Given the improving record of patent generation, for example, in the Federal University of Paraná, the state government could also consider boosting knowledge-based businesses by mobilising university students to identify technologies developed by the university that can be successfully put on the market and lead to new business formation. For example, the Technology Ventures programme at the University of Illinois at Chicago (UIC TVP) makes use of graduate students to launch businesses that commercialise promising technologies (see Box 3.9.)

Box 3.9. The Technology Ventures programme at the University of Illinois at Chicago

The Technology Ventures programme at the University of Illinois at Chicago (UIC TVP) makes use of graduate students to launch businesses that commercialise promising technologies. Chicago lacks a vibrant community of technology SMEs looking for new technologies and serial entrepreneurs. Although the Chicago investment community has shown keen interest in high tech spin-offs from the HE system, few have been established. At the same time, investors are often not able to see the potential in raw technologies. UIC TVP was established to provide a mechanism to bring high-potential technologies to the attention of investors.

Teams of graduate students (including MBA, MD, pharmacy and engineering) select technologies from amongst the hundreds owned by the university. They conduct market research, draft business plans on how to commercialise those technologies, negotiate with the faculty inventor to join their team and approach investors.

In its first year (2005-06), UIC TVP launched two start-ups. One was a biotechnology firm launched to commercialise a revolutionary cancer treatment. The other firm was seeking to bring to market an orthodontic device that reduced the time required for correcting orthodontic malocclusion (crooked teeth). During its second year, UIC TVP launched four more high-potential, high-tech firms, including a medical device for non-invasive cornea reshaping, an umbilical cord stem cell technology, a vascular imaging technology and a micro-fluidic device. Without UIC TVP, these technologies would have remained "on the shelf", out of sight of potential investors. UIC TVP has received national attention from the media, HEIs and investment groups.

Reasons for the success of UIC TVP include: *i*) hundreds of technologies owned by the university; *ii*) university's expertise, resources and a solid reputation in life sciences; *iii*) university's inventions, links to established biotech firms and recognition by potential investors; *iv*) support from university administration; *v*) student teams, that had an option to license the technology, giving them an incentive to ensure a successful venture; and *vi*) requirement to involve the faculty inventor in return for an equity stake in the business, providing incentives for the inventor to help the company to succeed.

The UIC TVP has faced obstacles such as: *i)* lack of capacity of local investors to evaluate business plans and risk aversion and reluctance to invest in businesses launched through the UIC; *ii*) lack of perceived legitimacy of student-owned businesses in the media and business/investment communities; *iii)* challenge to convince stakeholders that students were prepared to step aside when professional managers were successfully recruited; and *iv*) heavy work load on students.

Source: OECD (2007b), *Entrepreneurship Environment and Policies: Exploiting the Science and Technology Base in the Region of Halle*, LEED Discussion Paper, OECD Publishing.

In many OECD countries, small and medium-sized enterprises are engaged in clusters through associations that are able to articulate generic needs and purchase services collectively on behalf of a specific industry. While Paraná has strong industry sector collaboration through FIEP, there was limited evidence of long-term cluster-based development, for example, in agribusiness and tourism.

International experience of industry-driven cluster-based development with strong higher education participation comes for instance from the State of Victoria in Australia, where the dairy industry has formed an alliance with one of the tertiary education institutions, the Goulburn Ovens Institute to develop the National Centre for Dairy Education (see Box 3.10.).

Box 3.10. The National Centre for Dairy Education in Australia

The Australian dairy industry employs 40 000 people on farms and in manufacturing plans, related transport and distribution activities and on research and development projects. Dairy is one of Australia's major rural industries, with AUD 3.3 billion (2005/06) in farmgate production and AUD 2.7 billion a year in exports, making it the country's fifth largest agricultural exporter. However, the industry is facing considerable challenges: the number of farms has steadily decreased and input costs, such as water and feed have risen. This has intensified the need for farmers to be more cost-effective.

In 2005, the Australian Senate Inquiry into Rural Skills Training and Research found that it was increasingly difficult to attract and retain young people in agriculture, The range of jobs available, the training and educational opportunities and pay conditions in rural and regional areas were not as attractive as those in cities. Other industries were out-competing agriculture in the attraction and retention of talented, well-trained people. Furthermore, the "baby boomer" generation of farmers was coming up to retirement. Agricultural faculties and teaching staff at educational institutions across Australia contracted, reducing career opportunities for the young and restricting the learning system's capacity to meet the industry's needs. The Senate Inquiry concluded that agricultural industries should get involved with vocational training to ensure it is relevant, timely and aligned with the needs of the industry. In response to the inquiry, national dairy industry representatives and key industry bodies identified future education and training directions and Dairy Australia formed a partnership with Goulburn Ovens Institute of TAFE (GOTAFE) to address the dairy industry's education and training needs.

Box 3.10. The National Centre for Dairy Education in Australia (continued)

The National Centre for Dairy Education is an initiative of Dairy Australia and GOTAFE at Shepperton. It delivers nationally accredited short courses and customised programmes for dairy and processing organisation, individual farmers and people in the dairy service industry. Courses are offered in agriculture, food technology and food processing as part of a framework of re-skilling and up-skilling. An Industry Education Steering Committee (IESC) guides the direction of education and training, and ensures that the programmes remain relevant to the sector. A national network of nine industry advisory committees provides industry guidance on course content, priorities and outcomes. School-based apprenticeships or traineeships enabling secondary school student the opportunity to work with an employer and complete a nationally recognised qualification are also available. GOTAFE has responsibility for delivering the programme across Victoria.

Source: NCDEA (2010), National Centre for Dairy Education - Australia website, *www.ncdea.edu.au*, accessed 16 April 2010 and OECD (2010b), *Higher Education in Regional and City Development: The State of Victoria*, Australia, OECD, Paris., *www.oecd.org/dataoecd/54/14/46643288.pdf*

Whilst the universities in Paraná were able to provide examples of engagement with individual businesses, they found it more difficult to identify examples of well-established and systematic, good practice engagement involving industries or groups of firms. Much of the evidence was of research-led one-off collaborations initiated by university researchers or centres. There are, however, some early indicators of major institutional initiatives but they are at an early stage and lack demonstrable impact. Several examples may yield positive results if pursued over time with adequate resources, and are currently being branded as cluster or precinct initiatives. For example, the Itaipu Technological Park has a focus not only on renewable energies and biodiversity but also on tourism. With the establishment of the International University of Latin America it can grow into a strong cross-national hub in these fields.

Box 3.11. An international knowledge cluster promoting sustainable regional development

Itaipu Technological Park (PTI) carries out major research in the areas of hydro-electricity and security of facilities and also of bio-diversity and tourism development, while being the operator of the National Park of Catarata, the second tourism site in Brazil, in terms of number of visitors. The PTI is host to one of the campuses of UNIOESTE offering graduate courses in engineering and science (750 students in 2009). In 2009, PTI dispensed technical training to 2 000 people, with the Open University of Brazil (UAB) delivering courses to another 770 students and other institutions having an enrolment of 170 alumni. PTI houses an incubator with over 20 start-ups (Brazilian start-ups and also international ventures), mostly in the energy and environmental protection fields, now developing within the premises.

The PTI hosts the "Renewable Energies Observatory for Latin America and the Caribbean", created by the United Nations Industrial Development Organisation (UNIDO), *Itaipu Binacional and Eletrobras,* which aims in particular to establish an international demonstration area on renewable energies in the west of Paraná . This includes the creation of an agro-energy cooperative condominium for family agriculture with the bio-mass from agricultural activities and sewage systems to be used as sources of energy. The observatory will stimulate the use of other renewable energy resources (photovoltaic, wind, hydro etc). The action plan for 2009-10 comprises the establishment of a legal framework for renewable energies and energy efficiency in Brazil.

There is also considerable scope for increasing the knowledge transfer from universities to the Paraná tourism industry. Universities in Paraná could, for instance, help SMEs to better access global markets. Global value chains and networks encourage SMEs to make improvements in skills development, innovation and products and process. Policy measures and collaboration by universities and other tertiary education institutions are needed to ensure that SMEs do not miss out in their ability to compete with larger suppliers. Furthermore, universities could help in the development of analytical tools for the measurement and the evaluation of policy outcomes in tourism would help regional and local development authorities also in Paraná. Internationally, progress has been made in this domain, for example, by researchers at Nottingham University in the United Kingdom and the Sustainable Tourism Cooperative Research Centre (STCRC) in Australia, who are working with specially constructed tourism Computable General Equilibrium (CGE) Models, which can be used to estimate impacts of changes in tourism demand on the tourism sector and across the economy.

OECD countries and regions invest in tourism innovation programmes and to address specific barriers to tourism such as seasonality[3], peripherality and the challenges of the SME sector. For example, Sweden is developing a network for tourism research to improve competitiveness. Scotland has a dedicated tourism innovation programme and in Quebec, the Tourism Intelligence network was developed in collaboration between the University of Québec in Montreal and the public and private sector (see Box 3.12.).

Box 3.12. Programmes to support innovation in tourism

Nordic region

The Nordic region is actively promoting innovation in tourism and other services to overcome major barriers to tourism (*e.g.* seasonality, peripherality in relation to major tourism markets and small domestic tourism markets). Most policies are a result of national innovation programmes and not necessarily targeted at tourism only. For example, in Norway, Innovation Norway has funded the ARENA Programme to create regional clusters of tourism. For example, the Innovative Mountain Project aims to develop mountain tourism into an all-year activity with attractive products by network development, entrepreneurship and removal of barriers to innovation. The public sector as a lead partner pools expertise and resources and encourages co-operation with universities and private sector partners to enhance innovation and opportunities for business development.

Scotland Enterprise

Scotland has a dedicated tourism innovation programme led by its main economic development agency – Scottish Enterprise – addressing many of the policy weaknesses with specific innovation programmes and objectives to promote product development within the sector. It has secured major achievements in new product development, dovetailing with the private sector which drives elements of the innovation programme in conjunction with VisitScotland. Innovation is explicit as a policy objective in the tourism strategy – A Tourism Framework for Change to 2015. Outputs and achievements are regularly evaluated using international measurement tools. Innovation policies are promoted due to perceived low levels of innovation in the national economy.

Box 3.12. Programmes to support innovation in tourism (continued)

Quebec Tourism Intelligence Network

The Quebec Tourism Intelligence Network was developed in May 2004 as a partnership between the Quebec tourism industry and Tourism Quebec to support intelligence gathering in collaboration with the University of Quebec in Montreal. The organisation's purpose is to: "provide the Quebec tourism industry with a holistic knowledge base to improve industry operations and competitiveness and to help reduce internal competitiveness between organisations by providing a public knowledge base and disseminating it to the complete industry." The Tourism Intelligence Network is a structured industry tool for gathering and analysing information. It monitors changes in tourism around the world and produces brief analyses to Quebec decision makers working in SMEs.

Source: OECD (2010d), OECD Tourism Trends and Policies 2010, OECD, Paris.

Conclusions and recommendations

Brazil has developed a RDI support system with multiple players at different levels. The challenge of innovation in Brazil is not due to a lack of resources or entrepreneurial capacity, but rather in making the different levels of government, university and business efforts combine in order to produce tangible products, services and processes.

Paraná has developed the main components of a well-functioning regional innovation system (RIS) but continues to lack a state-level innovation law. Paraná is one of the Brazilian states that have invested significantly in science and technology in the last decade. It has been one of the few states that have developed public and private partnerships in order to get funding for private investment in R&D. Higher education institutions are increasingly seen as important "bricks" in the emerging regional innovation system in Paraná. However, more efforts are required in institutional development and linking different elements together. There is a need to improve collaboration between tertiary education institutions and businesses to fully articulate the RIS).

While the private sector has played an important role in identifying strategic strength areas and providing incentives for industry-university collaboration, limited access to resources for supporting R&D activities and

constraints on knowledge and technological transfer between higher education institutions and the business sector remain important issues to be addressed.

The RDI activities in universities and higher education institutions in Paraná are faced with a number of constraints. Second language capacity among RDI workers in universities and research institutes hinders their ability to co-operate with international partners and participate in RDI consortia. Despite good progress in recent years, the overall research production (articles published in international journals and patents) is low in comparative terms. There is also a lack of well defined research priorities resulting in research results that are only weakly aligned with state and national objectives. The lack of common evaluative procedures and performance indicators for research tends to result in low productivity and inefficient use of resources. The lack of sufficient multidisciplinary approaches and focus on science-driven activities in RDI act as a constraint for regional innovation. Successful RDI initiatives in the knowledge economy require a multidisciplinary perspective into the RDI projects and initiatives. Stronger alignment with regional needs would also be useful.

The effectiveness of universities and the relevance of their work depend on their autonomy and ability to be responsive to the needs of the end user of their RDI products. Rigid control of and the current governance systems hinder the flexibility of higher education institutions to play a more active role in innovation and regional development.

There are currently limited incentives for regional engagement of tertiary education institutions and their staff. Collaboration of tertiary education institutions with the private sector has so far been left to the will and initiative of single departments and individuals. A clearer strategy at both the state and institutional levels would enhance the impacts of such relationships on innovation and economic growth. This strategy should build on the existing strengths of the state and develop related sectors and technologies. Economic analysis shows that diversity among complementary economic activities with a common science base is more conducive to innovation than a narrow sector specialisation. Technologies with cross-sector fertilisation potential should be promoted.

Several critical elements should be taken into consideration in order to improve the contribution of higher education institutions in Paraná to regional innovation and development: comprehensive planning, institutional flexibility and targeted funding. In this sense key challenges for Paraná are to: *i*) develop a coherent policy of innovation, promoting prosperity and sustainable growth for all the citizens; *ii)* strengthen clusters between governments, businesses and universities; *iii)* develop, implement and

evaluate a comprehensive process among the key actors with specific objectives for research and regional innovation; *iv*) develop processes of reflection on the role of higher education institutions in order to better respond to the social and economic needs of the community; *v*) promote a more proactive role in higher education institutions, becoming the engine for social and economic development at the region; *vi*) encourage partnerships between businesses and universities; *vii*) promote spin-offs, incubators science parks and clusters; *viii*) develop a system of incentives in order to promote collaboration between universities and industries; and *ix*) incorporate policies for promotion and recognition of academics in universities innovation activities and extension.

The OECD review team recommends that the following measures are taken to promote regional innovation:

- The federal and state governments should review the incentives for higher education institutions to facilitate a move from knowledge production to knowledge exchange and transfer, to encourage university-industry partnerships, to enhance universities' more concrete participation in innovation activities and to ensure that universities perceive job creation as one of the main goals of innovation.

- The federal and state government should improve the evaluation and assessment of funded RDI initiatives to ensure accountability of the use of publicly allocated resources. These include criteria and measures of quality and relevance to the socio-economic needs of society such as: *i)* continued relevance of the RDI programme to its original stated objectives; *ii)* programme results and the achievement of objectives; *iii)* impacts of the programme on its stakeholders; and *iv)* cost-effectiveness of the programme.

- The federal and state governments should develop the existing funding models of the higher education institutions to improve their accountability, specialisation and efficiency. A performance-based funding system introducing competitive funds could provide greater incentives for industry and regional engagement of universities. The system could also include: *i)* formulae for block grant funding that includes higher weights for enrolment of students from within the region, for students from lower socio-economic and/or migrant backgrounds or for enrolments in academic programmes related to regional labour market needs; *ii)* policies governing tuition fees to provide for lower fees for students from the region and policies for financial aid to students; iii) eligibility for special or "categorical" funding that could be contingent on evidence of regional engagement and focus; *iv)* requirements that institutions collaborate in order to

obtain funding; and v) special funding to provide matching of funding obtained by universities from contracts with regional employers for education and training services. The state government could consider establishing a special regional investment fund (funded from public and private resources) to provide funding for building university capacity for regional engagement and provide incentive funds to institutions and individual faculty members for regional initiatives. These could emphasise engaging faculty members and students in teaching/learning and applied research projects related to regional priorities. To ensure return on public investment and stronger accountability, higher education institutions and state government should improve their mechanisms for following-up and monitoring the success of their programmes.

- The state government, in collaboration with the leading higher education institutions and the business sector, should develop and implement a comprehensive, multi-year strategic planning process aimed at defining concrete goals for regional development, innovation, growth and sustainability, drawing on the multi-stakeholder strategy work conducted by the key regional stakeholders. This should be conceived as a joint-venture of the public and leading private universities, business and industry. Efforts to unify the main goals for innovation in the region in the short-to-medium-term should seek to identify a central focus. Innovation authorities should guard against pursuing too many goals simultaneously and/or dispersing resources. Co-operation among private sector businesses, public administration, regional/municipal development agencies and higher education institutions should be expanded. State government could also take steps to encourage stronger regional collaboration among the higher education sectors in Paraná. Collaboration between the state government and universities should be enhanced, for example, through mobilising university capacity for the development and implementation of regional development strategies and using university expertise for regional development.

- The state government could focus on cluster-based regional development, ensuring that research on clusters and demands of industry extend into service sector and include clusters such as tourism. Clusters should be conceptualised as cutting across the manufacturing-service divide – for example, agribusiness clusters usually connect with tourism and manufacturing innovations incorporate service components. Technologies with cross-sector fertilisation potential should be promoted.

- The state government should implement collaborative efforts to improve internationalisation of Paraná, its business sector and universities. It could consider co-ordinating efforts to improve English as a second language capacity of all RDI workers by funding targeted second language programmes, and providing adequate incentives for faculty to learn a second language in all higher education institutions. It could consider establishing talent attraction programmes for attracting high skills and professional technical labour (students, researchers, IT specialists, research scientists etc.). Policy instruments include employee tax incentives, repatriation schemes and improving the attractiveness of academic careers. To be more effective, these policies need to become an integral part of the international co-operation strategy of the region. They can be coupled with initiatives to attract foreign investment.

- The state government should encourage collaboration between the higher education institutions and local SMEs. Policy tools include people-based mobility schemes, such as the Knowledge Transfer Partnership in UK, that improve the absorptive capacity of local enterprises and support for the forum role of higher education institutions to reinforce the regional engagement channels. A relatively low-cost policy measure that have been implemented in a number of countries, for example, the Netherlands, the UK and Ireland, is innovation vouchers that expose firms to innovation activities and stimulate a market for innovation. They are small-scale lump sums that firms receive to undertake simple innovative projects. At the operational level, innovation vouchers can be aligned to meet specific needs and objectives, for instance, they can focus on specific sectors or technologies or business-to-business collaboration by only allowing applications from groups of firms. Different rounds of calls for applications can be organised to meet different goals and needs.

- The higher education institutions should engage in more proactive, systematic and institutional collaboration with the local business and industry to drive socio-economic development in the region. This collaboration should focus on areas where Paraná has a real or potential comparative advantage. The institutions should improve the links with the local manufacturing sector to encourage the introduction of product and process innovations. The institutions should improve their capacity to engage with the local industry by developing a regional development strategy that would encompass technology transfer and innovation as well as new business generation and by establishing a professional knowledge transfer offices that actively reach out to local businesses and industry with the aim of long-term collaboration. Single entry points for industry and SMEs within a higher education institution or a group of

institutions should be encouraged. Universities should collaborate with the local business to design research programmes and activities that are more strongly aligned with regional needs and to ensure that local firms are aware of the benefits of hiring graduates. Collaborative research programmes could help improve links between the higher education and business sectors.

- The state government should implement concrete collaborative efforts with private and public stakeholders in areas that strengthen social equity and environmental quality. For this purpose, the state government should develop (or adapt) a specific regional funding programme for combined and collaborative efforts conducted by both public universities in projects of higher education, science and technology. Higher education institutions should engage in challenge-driven research, using the region and its diverse range of challenges as a "laboratory" for developing research and innovations. Combining community outreach into training and challenge-driven research can generate improvements in life quality and low tech innovations.

Notes

1. In 2010, The Brazilian government aimed to invest approximately 1.5% of its Gross Domestic Product (GDP) in advancing science, technology and innovation. Based on Brazil's 2008 GDP figures, that would correspond to BRL 43.3 billion. The Science, Technology and Innovation for National Development Action Plan 2007-2010 outlines how Brazil hopes to achieve this target through a mix of instruments and programmes including financing with reduced real interest rates, tax incentives and economic subsidies.

2. In 2005, Brazil was in 13th position among countries applying for patents, behind China in 3rd place, Korea in 4th and India in 11th. In the same year, the number of patents requested in Brazil relative to the previous year fell by 13.8%; while in China there was a growth of 32.9%, in Korea 14.8% and in India 1.3%. 2005 data from the World Intellectual Property Organization (WIPO) show that in Brazil, 2 439 patents were granted, more than in India, which had 1 840 patents, but far fewer than the 53 300 patents in China and the 74 500 in Korea (MCT, 2007).

3. In Spain, to reduce seasonal variations in tourism, a project called Turismo Senior Europa has been launched to increase Spain's winter tourism by showcasing the low-season potential of Spanish destinations to tap into a target public of over 100 million EU citizens in the 55-75 age bracket, 50% of whom have never travelled outside their home countries. This will be the driving force behind a revitalisation of the low season and an improvement of the sector's profitability and sustainability.

Annex 3.1. State spending in science and technology

Table 3.1.1 Percentage of states spending in science and technology related to the state public budget income, 2000-08

Regions and selected states	2000	2001	2002	2003	2004	2005	2006	2007	2008
North	1.87	1.96	1.83	1.77	1.63	1.46	1.4	1.66	1.7
North-East	.27	.23	19	24	.24	.33	.53	.56	.66
Centre-West	0.51	.68	.62	.72	.69	.75	.74	.79	.95
South-East	.28	.21	.07	12	.26	.28	.27	.48	.42
Expírito Santo	3.1	3.2	3.09	2.84	2.53	2.16	2.02	2.46	2.43
Minas Gerais	0.5	0.24	0.2	14	0.13	0.16	0.25	0.26	.25
Rio de Janeiro	46	54	34	.26	.49	.61	.75	.96	1.01
São Paulo	4.72	5.06	4.89	4.71	4.07	3.35	3.09	3.67	3.56
South	1.08	1.25	1.22	1.14	1.24	1.25	1.26	1.27	1.43
Paraná	1.8	2.25	2.57	2.2	2.57	2.36	2.47	2.67	2.27
Rio Grande do Sul	89	94	44	44	49	51	38	36	.32
Santa Catarina	.89	.94	.44	.44	.49	.51	.38	.36	.32
Total	1.87	1.96	1.83	1.77	1.63	1.46	1.4	1.66	1.7

Source: Ministry of Science and Technology (*Minsitério da Ciência e Technologia – MCT)* www.mct.gov.br/index.php/content/view/740.html

Table 3.1.2. Percentage of states spending in science and technology related to their gross domestic product, 2000-08

Regions and selected states	2000	2001	2002	2003	2004	2005	2006	2007
Brazil	1.3	1.33	1.3	1.26	1.24	1.27	1.28	1.38
South East								
Espírito Santo	0.07	0.04	0.03	0.02	0.02	0.02	0.04	0.04
Minas Gerais	0.06	0.08	0.04	0.03	0.06	0.08	0.1	.13
Rio de Janeiro	.18	.15	.11	.12	.12	.12	.11	.14
São Paulo	.48	.52	.51	.47	.42	.35	.32	.39
South								
Paraná	.26	.26	.29	.22	.26	.26	.27	.26
Rio Grande do Sul	.1	.11	.05	.05	05	.06	.04	.04
Santa Catarina	.01	.01	.08	.08	.05	.01	.07	.08

Source: MCT (Ministry of Science and Education) (2010) and IBGE, (Brazilian Institute of Geography and Statistics), *www.ibge.gov.br/english.*

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Annex I: OECD Review Team

Ernesto Flores joined the OECD Programme on Institutional Management in Higher Education (IMHE) in Paris in 2009 for a 15-month secondment to support the OECD review programme Higher Education in Regional and City Development. He holds a master's degree from Monterrey Institute of Technology and Advanced Studies, Mexico. He has worked as a Consultant in the Quality Centre of Monterrey Tech, developing projects in several companies. In 2002, he was invited to collaborate to the Strategic Planning and Regional Development Office of the Executive Office of the President of Mexico, where, he served as planner and consultant in strategic planning for Federal Government offices to align actions consistent with the Mexico's National Development Plan. Since 2004, he has worked at the Sonora Institute of Technology (*Instituto Tecnológico de Sonora*, ITSON) as planning co-ordinator in projects aimed at improving economic and social performance in the region, such as the creation of the Technology Park and the Digital City initiatives as well as international projects in innovation-based regional development.

Philip Wade, retired (2007) OECD Administrator, is an expert in regional and rural development, with specific knowledge in Information and Communication Technologies (ICTs). In OECD, Wade was responsible for several national territorial reviews in Europe, with the objective to identify and analyse the factors of disparity between regions and the implementation of regional policy, so as to formulate recommendations aiming to improve its delivery and increase its impact. He also carried out specific regional tasks and authored several rural case studies, and before that, the OECD report "ICTs and Rural Development". Presently, Wade is one of two experts, coordinating and supervising, under the aegis of the Government of Finland, a pilot rural development project in Mozambique. Prior experience in such countries was acquired in the field of technical assistance in Peru and Ethiopia. Philip Wade is a graduate in political science from Paris Sorbonne and in economics, law and public administration from ENA. He holds a degree in Higher Latin American Studies (IHEAL). Before joining OECD, he worked in various international positions in the public and private

sectors in France. Besides OECD publications, he is the author of several books on broadcasting, ICTs and tourism development.

José-Ginés Mora, is visiting professor at the Institute of Education, University of London. His research is focused on higher education and he is author of more than two hundred and twenty publications. He is an expert in European higher education; higher education management; quality assurance; economics of education and higher education financing. He is external advisor to the Spanish Ministry of Innovation and Science, member of the Bologna Follow-Up Group, former Deputy-Chair of the Governing Board of the Institutional Higher Education Programme (IMHE) of the OECD, former President of the EAIR (the European Higher Education Society), and ex-member of the Steering Committee of ENQA (the European Association for Quality Assurance in Higher Education). He is associate editor of Tertiary Education and Management and member of the Editorial Boards of Higher Education Policy, Higher Education in Europe, Higher Education Quarterly and Higher Education Management and Policy, and ex-Joint Editor of the European Journal of Education. He has worked as consultant for higher education matters for several governments and international organisations (EC, World Bank, OECD).

Carlos R. Azzoni is Dean of the School of Economics, Administration and Accounting of the University of São Paulo (USP). He is professor of economics at USP (from 1973). He was visiting professor at Cornell University, USA, Ohio State University, USA and University of Illinois, USA. His area of research is in economic inequality, with a focus on regional inequality. He has worked for seven years at the State of Sao Paulo Secretary of Planning, chairing the regional planning division of that agency. He has published 7 books and over 50 scientific papers, both in Brazilian and international refereed academic journals. He has worked as consultant for many Brazilian organisations, both in the private and public sector. He has also worked as consultant for the World Bank, the Inter American Development Bank and the OECD.

Salvador Malo is Research Director at the Mexican Competitiveness Institute (IMCO). With a degree in physics from the National Autonomous University of Mexico (UNAM) and a doctorate in physics from Imperial College at the University of London, he worked for three years at the International Atomic Energy Agency in Vienna, Austria. Malo conducted surface science research for several years at Mexico's Instituto Mexicano del Petroleo (an oil industry-related technical and research centre), where he held several positions, including Vice-President of Research. Before joining IMCO, he served as director general of CENEVAL, A.C., Mexico's National Centre for Quality Assessment in Higher Education. He has a long career in science and higher education, and was a member of the Mexican

Task Force Group for Collaboration in Higher Education in North America. He later joined the Mexican Department of Education and initiated several programmes to promote development of the sciences in Mexican state universities, including the well-known *Sistema Nacional de Investigadores*. His past positions at UNAM include Vice-President for Planning, professor in the School of Sciences and UNAM's Center for University Studies, as well as and Secretary General and Vice-President of Administration. In addition to his scholarly work in physics, he has published numerous articles, essays and chapters in books on topics related to educational development, research and technology in Mexico. He is author or co-author of several books.

Annex II Programme of the review visit

OECD REVIEW VISIT TO THE STATE OF PARANÁ
5 – 11 DECEMBER 2010

SUNDAY 5 DECEMBER 2010

18:00 **OECD Review Team Internal meeting**

20:00-21:30 **OECD Review Team Meeting with Regional Co-ordinator**

- Cássio Rolim (Regional Coordinator, Federal University of Paraná)
- Mauricio Serra (Regional Vice-Coordinator, Federal University of Paraná)

MONDAY 6 DECEMBER 2010

9:00 - 10:00 **Meeting with the Comite Deliberativo (Regional Steering Committee) and Forum Futuro Parana 10**

- Host: Zaki Akel Sobrinho (Rector, Federal University of Paraná)

10:00-12:00 **Meeting with the regional coordinating team**

- Host: Cássio Rolim (Regional Coordinator, Federal University of Paraná)

14:00-15:30 **Meeting at PRPPG-UFPR (post-graduate education and research staff)**

- Host: Sergio Scheer (Provost for post-graduate education and research, Federal University of Paraná)

16:00-18:00 **Meeting with TECPAR's staff (Institute of Technology of Parana)**

- Host: Aldair Rizzi (President, TECPAR)

TUESDAY 7 DECEMBER 2010

08:15 –09:50 **Meeting with Agencia Curitiba de Desenvolvimento and stakeholders**

- Host: Juraci Barbosa Sobrinho (President, Agencia Curitiba de Desenvolvimento)

10:00 – 12:00 **Meeting at PROGRAD-UFPR (teaching staff)**

- Host: Maria Amélia Sabbag (Provost for undergraduate education, Federal University of Paraná)

14:00 – 16:00 **Meeting at CIETEP-FIEP with FIEP staff**

- Host: Sandro Vieira (Director, FIEP)

16:00 - 17:30 Carlos Azzoni, Ernesto Flores and Salvador Malo continue with a meeting at CIETEP

WEDNESDAY 8 December 2010

Review team splits:

9:00 – 13:00 **Team Northern Paraná: Meeting at FECEA, Apucarana**

- Host: Rogerio Ribeiro (FECEA); Alexandre Farina (Terra Roxa Investimentos)

8:30 – 12:00 **Team West Paraná: Meeting at Foz do Iguassu, Itaipu Technological Park (PTI)**

- Host: Juan Carlos Sotuyo (Director, PTI)

Team at Curitiba

9:00 – 11:30 **Carlos Azzoni – Meeting at Secretaria de Planejamento**

- Host: Antonio Carlos Lugnani (Co-ordinator of Regional Planning)

14:30: 16:00 **Carlos Azzoni - Meeting at Fundação Araucaria**

- Host: Zeferino Perin (President, Fundação Araucaria)

16:30 – 17:30 **Carlos Azzoni - Meeting at CIEE –Centro Integração Escola Empresa (CIEE)**

- Host: Luiz Nicolau Mäder Sunyé (President, CIEE)

9:00 – 11:30	**Ernesto Flores & Salvador Malo – Meeting at LACTEC** • Host: Jorge Bounassar (Director, LACTEC)
14:30: 17:00	**Ernesto Flores and Salvador Malo – Meeting at COPEL – Departamento de Novos Negocios** • Host: Jun Kitagawa (Manager)

THURSDAY 9 DECEMBER 2010

9:00 - 11:00	**Meeting with the staff of the Federal Technological University (UTFPR)** • Host: Paulo Osmar Dias Barbosa (Vice-Rector, UTFPR)
14:00 - 16:30	**Meeting with the staff of the Catholic University (PUC-Pr)** • Host: Waldemiro Gremski (Provost for post-graduate education and research, PUC-Pr)

FRIDAY 10 DECEMBER 2010

9:00 - 10:30	**Abertura do Forum Parana FUTURO 10** • Host: Rogerio Mainardes (Coordinator, Forum Parana Futuro 10)
10:45 – 14:30	**Internal meeting of the review team**
15:00 – 17:00	**Feedback session to the Regional Steering committee** • Host: Zaki Akel Sobrinho (Rector, Federal University of Parana)

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Higher Education in Regional and City Development

State of Paraná, Brazil

Paraná is one of the most prosperous states in Brazil and has invested in higher education, science and technology, and public-private partnerships. Its higher education scene is dominated by federal and state universities, but the private sector enrols a much higher number of students, particularly from low socio-economic backgrounds.

Faced with growing global competition, how can Paraná build its capacity as an internationally attractive place to live, work, invest and study? How can it promote business formation and develop its existing industry and small and medium-sized enterprises? How can it address the long-term challenges of poverty and inequality? How can its higher education sector support this development?

This publication is part of the series of OECD reviews of Higher Education in Regional and City Development. These reviews help mobilise higher education institutions for economic, social and cultural development of cities and regions. They analyse how the higher education system impacts upon regional and local development and bring together universities, other higher education institutions and public and private agencies to identify strategic goals and to work towards them.

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