Southern Arizona, United States of America
Assessment and recommendations

Southern Arizona region: from a resource-based economy to a knowledge-based economy

Southern Arizona is the southern-most part of the state of Arizona in the United States, bordering the Mexican state of Sonora, with a multi-cultural heritage and a major gateway for trade with Mexico. The vast desert region consists of Pima County, Cochise County and Santa Cruz County, and has a population of approximately 1.2 million, accounting for 18% of the state population. The engine of the region’s development is the Tucson metropolitan area, the second largest metropolitan area in the state, just behind the Phoenix metropolitan area. About 23% of the land in Southern Arizona is owned by Native Americans, Tohono O’odham and Pascua Yaqui Nations, who continue to feature low education, labour market and health outcomes.

Population growth is a major strength in the region, an opportunity for many industry sectors, but at the same time it poses cultural, economic and political challenges. Since World War II, Arizona has had one of the fastest growing populations in the United States. Between 1990 and 2000, Arizona experienced a 40.0% population increase which slowed down to 26.7% between 2000 and 2008. In Southern Arizona, the corresponding figures were 26.0% and 18.4%. Arizona has the fastest growing Hispanic population in the US, comprising about 25% of the state population and 27% of that of Southern Arizona. In Tucson, 40% of the residents identify themselves as Hispanic, while in Santa Cruz the majority of population are Hispanic. High birth rates and the fact that Southern Arizona is also a popular retirement destination have resulted in a cultural mix of high-end retirees and young Hispanics who have different social and political needs and expectations. At the same time, there is outmigration to Phoenix and
other US cities by a population of young, single and college-graduated demographic.

GDP per capita and average earnings in the state of Arizona consistently lag behind the US averages. The Tucson metropolitan region ranks near the bottom third of American cities in per capita income, and its ranking has declined in the past few years. While there are growing intraregional disparities in Southern Arizona, poverty rates have increased in all three counties during the past 30 years. Santa Cruz has a particularly low income average and a high poverty rate at 18.6%, compared to the national and state average of 13.3% (2000 figures). Unemployment figures vary by county, Santa Cruz featuring higher levels of unemployment than the US or Southern Arizona as a whole.

The regional economy is largely dependent on the public sector, particularly the education and defence sectors. Strong investments have been made in selected high technology fields, and the Tucson metropolitan region has emerged as a hub of light-based industries. The greatest sources of employment in Arizona are the services, trade and construction sectors, with service jobs accounting for 1 million jobs in 2006. Wholesale and retail trade provided 428,000 jobs, many related to tourism. Despite recent setbacks in total direct spending and employment, tourism continues to play a major role in the regional economy, bringing an estimated USD 12-18 billion annually to the state economy. The tourism and travel industry had the largest share of employment at 11.1%, followed by health care and biotechnology at 7.2%. The greatest job growth – about 30% – is projected in health-related occupations. The region has both large and small companies, the latter generating 80% of all jobs. The defence industry is an important actor, with Raytheon Missile Systems being the largest single employer in Southern Arizona, followed by the University of Arizona and the state government of Arizona.

The major challenge for Southern Arizona is to expand the economic base in order to move to a high-wage, knowledge-based economy. For this to happen a more inclusive and effective human capital development and innovation system needs to be developed against a backdrop of growing demands and constantly decreasing state public expenditure on education. Expenditure per student in Arizona is considerably lower than the national average for the last number of years and Arizona lags behind the US average in the educational attainment of young people: 31.8% of adults aged 25-34 in Southern Arizona have an associate or higher degree whereas the national figure is significantly higher at 40.39%. An important underlying factor is the disparities in educational attainment between racial and ethnic groups: Hispanic and Native Americans lag behind whites in educational attainment at all levels. There is a need to acknowledge that all children and
youth, irrespective of their citizenship or legal status, have the right to education.

Southern Arizona’s tertiary education includes a Land Grant university with a strong interdisciplinary tradition and world class research and a responsive community college sector, which both contribute to an ecosystem of collaborative networks in selected fields, particularly within the Tucson metropolitan region. At the same time, there is a lack of vision and steering mechanisms for tertiary education as a state or regional system. Public good missions and academic quality are under threat because of declining funding and the regional innovation system remains underdeveloped and in risk of fragmentation.

In this context, the key challenges for Southern Arizona and its tertiary education institutions are the following:

- How to improve the overall educational attainment levels and the flexibility of the population to face the changes in the labour market? How to improve the relevance, inclusiveness and quality of tertiary education and better align it with regional needs?
- How to develop an effective regional innovation system which promotes long term collaboration between tertiary education institutions and industry?
- How to leverage the current economic base and retain and grow existing businesses in order to expand the economic base? How to improve the absorptive capacity of the SMEs? How to promote new business formation and attract knowledge-based businesses and investment?
- How to address the socio-economic gaps, health and other needs of the diverse population?

In a time of financial stringency, there is a need to preserve the existing areas of strengths in the tertiary education institutions, while addressing the needs of the diverse population. The authorities and the Arizona legislature need to recognise the importance of education for economic development and guarantee sustainability by sufficient funding levels. A co-ordinated approach to human capital development should be developed, including a master plan with vision, goals, milestones, co-ordination measures and a robust evidence base. At the regional level, joint public-private multi-stakeholder efforts are needed to design a balanced vision for Southern Arizona’s economic, cultural, social and environmental development. Skills and job creation in the region should be seen as the primary goal of innovation and human capital development. A systematic approach should
be adopted to knowledge transfer between tertiary education institutions and industries in Southern Arizona. The existing good practice examples in widening access to and improving success in tertiary education, industry-university collaboration and community outreach should be disseminated, extended and scaled up within and between tertiary education institutions.

Human capital development in Southern Arizona

Cultivating relevant skills for local growth is the best guarantee that a region will thrive in future. If Southern Arizona wants to become globally competitive, it needs to have highly skilled workforce and knowledge-based economy. Investments in education are necessary to widen access and improve the educational attainment levels.

Southern Arizona has a low educational attainment level that limits the region’s ability to develop a knowledge economy, and to attract and retain highly-skilled workforce and knowledge-intensive and high value investments. The tertiary education attainment rate in Southern Arizona was 31.8% for adults aged 25-34 falling short of the OECD and national averages (34.15% and 40.39%, respectively). In the context of the United States’ aim to restore its status as a world leader of tertiary education graduates by 2020, Southern Arizona needs to significantly increase the number of tertiary education graduates; otherwise it runs a risk of falling further behind the rest of the country in economic development and innovation outcomes.

All children and youth, irrespective of their nationality and legal status, should have access to education. Barriers to education arise from undocumented status of immigrant students; quality and equity problems in K-12 education; and underfunding and costs of education. Significant numbers of high school graduates in Southern Arizona are from undocumented immigrant families, which limit their possibilities to enrol in public tertiary education institutions. The political volatility of the issue of the undocumented status of immigrant students creates considerable barriers to promoting tertiary access to a significant segment of the graduating high school student population in the region.

There is insufficient level of preparation of incoming students, due to serious quality and equity problems in K-12 education. The proportion of high school graduates who are not ready for college is estimated at
anywhere between 50% and 80%. With a high school completion rate of 82%, the state is below the national average of 86% and considerably below the 94% performance of the top states in the US. The probability of completing high school for students from low-income families is one-third lower than for students from a high-income background. The proportion of low-income 8th graders scoring at or above “proficient” on the national assessment math exam is only 12%, compared to 22% in the top states.

In Arizona as in other US states, the cost of tertiary education is a deterrent to participation of students from low-income families. In 2006, the cost of attending community college represented 25% of the average family income while attendance at a public four-year institution was equivalent to 31% of the average income, up from 25% in 1992. For the lowest quintile, the net cost of attending a public university went up from 59% of family income to 73% in 2005, one of the highest proportions in the entire nation. Compared to other states, Arizona provides very little state financial aid. In 2009, the state allocated only USD 26 per student on financial aid, compared to an average figure of USD 549 nation-wide (CHE, 2009). The State of Arizona is therefore spending a mere 4.7% of the national average for student aid.

As a consequence of the diminishing level of funding for tertiary education, accentuated by the financial crisis, the University of Arizona has increased the tuition fees and also increased the proportion of out-of-state undergraduate students in order to make up for the shortfall in budgetary resources. Despite the improved support for students of low socio-economic backgrounds, it is becoming more difficult for in-state students to enrol in the local public university.

To widen access and to increase tertiary education attainment levels, the appropriate financial resources need to be mobilised. The University of Arizona should further improve its accessibility.

Overcoming quality and equity gaps in education is not the direct responsibility of the tertiary education institutions. It is up to the Arizona legislature to mobilise sustainable funding and the school authorities to work towards improving the quality of education. But tertiary education institutions can and should do more to improve access and success in education. There is a need for a region-wide long-term public-private collaboration underpinned with sustainable funding.
Overcoming quality and equity gaps is not the direct responsibility of the local tertiary education institutions. In the first instance, it is up to the Arizona legislature and the school authorities to work towards improving the quality of education in the state of Arizona. They will need to address these issues in a comprehensive manner and mobilise appropriate levels of financial resources in spite of the economic downturn.

However, tertiary education institutions can and should do more to improve access and success in education. Currently, the most notable is the regional public-private initiative “Tucson Values Teachers” which aims to improve the quality of K-12 teaching in the Tucson area. In addition, each institution has developed its own outreach activities. For example, Cochise Community College offers a technical preparation programme throughout the county high schools to boost up the skills of potential students. Tohono O’odham Community College maintains an open enrolment policy and has partnered with the University of Arizona since 2000 on an initiative to train teachers who are tribal members. Pima Community College runs two federally funded college preparation programmes, Talent Search and Upward Bound that offer academic advice, tutoring, and assistance with admissions and financial aid applications. Given the current insufficient level of preparation of incoming students into tertiary education, long-term region-wide public-private collaboration is needed in order to improve the motivation and academic performance of pre-college students.

Improving retention and progression in tertiary education will require, among other things, a higher rate of transfer between community colleges and four-year institutions. Better functioning pathways and bridges between community colleges and the university should be developed.

One of the major strengths of the tertiary education system in Southern Arizona, and the United States in general, is the high degree of institutional differentiation, which allows catering for the learning and training needs of an increasingly diversified student population. Southern Arizona has a comprehensive network of tertiary education institutions consisting of a major research university; three community colleges embedded in their communities and with branch campuses aligned with the geographical distribution of the local population; and private institutions catering to the training needs of the working population.

To increase the completion rates of tertiary education and to up-skill the local workforce, there needs to be a higher rate of transfer between the
community colleges and the university. Currently, the articulation between the community colleges and the University of Arizona is governed by a state-wide agreement. Students can transfer through two mechanisms: either by using an associate degree which transfers as a block of 64 credits or by completing a general education block of 35 credits called the Arizona General Education Agreement. There is room for clearer transfer rules and conditions in order to ensure that a more significant proportion of community college students transfer to universities.

Ensuring smooth articulation requires close collaboration among all institutions concerned, including joint planning and regular communication between faculty members at the University of Arizona and at the community colleges to ensure comparability of course content, appropriate advising for students, and overall alignment of programmes. Recently, progress has been made in this domain through closer collaboration between the university and the Pima Community College. A common course numbering system would facilitate better functioning pathways. In Florida this type of a system has ensured efficient and effective progression among its 11 state universities and 28 community colleges.

Widening access is also about making sure that students from disadvantaged backgrounds do not face additional barriers to succeed in education. Tertiary education institutions should do more to improve graduation rates and help graduate retention in the region through closer industry collaboration.

Widening access is not only about providing equal opportunities to enrol in a tertiary education institution, but also about making sure that students from disadvantaged backgrounds do not face additional barriers to succeed beyond their own efforts and motivation to achieve good academic results. Retention and graduation rates are important indicators of whether a tertiary system or institution is supportive of students’ progression after admission. Currently the tertiary education institutions in Southern Arizona demonstrate a relatively low level of efficiency in graduate production. The graduation rates in the US community colleges are generally at a low level and the community colleges in Southern Arizona do not make an exception to this. The graduation rate of the University of Arizona is 56%, much lower than that of public research universities with high research intensity (70%) (ACT, 2008).

Tertiary education institutions should develop more relevant academic, social and financial support to ensure success in education.
The tertiary education institutions in Southern Arizona effectively contribute to the formation of a quality labour force for the region. They offer academic programmes in all of the cluster priority areas identified by the Tucson Regional Economic Opportunities Agency (TREO), the regional economic development agency; with the exception of tourism, which is a growth area in the regional economy. To improve graduate retention and the quality and attractiveness of local jobs, the tertiary education institutions should continue their efforts to align the educational programmes with the regional needs, including fields currently neglected. Sustained efforts should be made to establish programmes to link all students, graduates and post-graduates with the local industry. Creating ties between students and regional employers through internships, and co-operative programmes should be made a priority in all institutions. A broader range of students should be able to benefit from innovative, experiential learning models and entrepreneurship training. It will also be important to adjust the performance evaluation system to ensure that there are appropriate incentives to ensure that faculty members are equally devoted to undergraduate teaching as to their research and technology transfer activities.

Internal and external administrative barriers and a lack of incentives may impede students, researchers, professors and administrators to engage in entrepreneurship, industry collaboration and regional development activities. Tertiary education institutions need to create synergies between education, research, industry collaboration and entrepreneurship, and create an incentive structure to encourage such activities, including in the criteria for staff promotion and tenure.

The following measures would promote human capital development in the Southern Arizona region:

- To improve the quality of high school graduates, the local school authorities should address existing academic and equity gaps in a comprehensive manner and mobilise appropriate levels of financial resources in spite of the economic downturn.

- In order to widen access to tertiary education, especially among underserved population groups, all concerned tertiary education institutions should step up their outreach efforts and share good practices among themselves in a more systematic manner. The joint admission programme between the University of Arizona and Pima Community College appears to operate smoothly in that respect. A similar mechanism to link the University with Cochise Community College and Tohono O’odham College could be envisaged. It would also be useful to implement a common course
numbering system for the entire State along the lines of the Florida system. Furthermore, in implementing its strategy to cope with the financial crisis, the University of Arizona should carefully monitor the rise in the proportion of out-of-state students to avoid any adverse equity impact in the medium term. Access to the University must be improved.

- Tohono O’odham College needs to be included more systematically into the tertiary education community of the Southern Arizona Region. All parties concerned should identify ways of supporting the efforts of the younger public institution to draw more extensively on existing resources in the community.

- Tertiary education institutions should continue to align their educational provision with the needs of the region, and also address needs of skills development in industries relevant to the region, including tourism which is one of the key drivers of the regional economy.

- To further improve its pedagogical practices the University of Arizona should ensure a more systematic and widespread sharing of experiences across colleges and programmes. All students should be able to benefit from innovative and experiential learning models including entrepreneurship education. The expertise of the McGuire Center for Entrepreneurship should be mobilised to transform education provision throughout the university and other tertiary education institutions in the region and to scale up the entrepreneurial activities of the university faculty. The challenge will be to facilitate increased cross-fertilisation and institutional learning without stifling the existing culture of faculty-driven innovation. Appropriate incentives need to be in place to ensure that faculty members are equally devoted to undergraduate teaching as to their research and technology transfer activities. The University of Arizona should also consider applying evaluation instruments, such as the Collegiate Learning Assessment (CLA), to measure the generic competencies and higher order skills that students are acquiring in the course of their programmes.
Innovation in Southern Arizona

The US leadership role in pro-innovation policies has recently been challenged by other OECD countries. To face these challenges, the federal government has taken steps to reassume its leading role. The state of Arizona and Tucson Regional Economic Opportunities, TREO, also invest in innovation with focus on high technology fields.

The United States has traditionally led the way in developing pro-innovation policies. It was the first country in the world to offer companies a R&D tax credit and, through the 1980 Bayh-Dole Act, the first to allow universities to patent products originating from federal R&D funds. The Massachusetts Institute of Technology (MIT) and Stanford University are global leaders in commercialising university research, and the Silicon Valley and Route 128 continue to inspire many regions.

At the same time, there is growing evidence that other OECD countries are catching up to the US in terms of capacity for innovation. This catching-up process takes place in four domains: human capital development, taxation policies, commercialisation of research and innovation policy. As most US university technology licensing/transfer offices generate less licensing revenue for the university than the cost of their operations, the traditional technology transfer model is also becoming under increasing pressure. Many universities have also focused on technology transfer or developing revenue streams from products that have limited or no relation to the regional economy.

The US federal government’s role in innovation has until recently been limited to funding basic research, subsidising the education of scientists and engineers, and maintaining a system of intellectual property law. In 2009, the government assumed a more active role with the aim to transform the United States into an “Innovation Economy” that would support innovation for sustainable growth and quality jobs. The goal is to restore the US leadership in fundamental research, to build a world-class workforce, to develop a physical infrastructure, and to develop an advanced IT ecosystem. This will in turn form the basis for innovation that will promote competitive markets that are able to spur productive entrepreneurship and catalyse breakthrough discoveries for national priorities; for example, in clean energy, health care and advanced vehicle technologies.
While many US state and local governments have established technology-based economic development programmes to promote innovation, these programmes often focus on the same high technology field, regardless of whether they are suited to the regional and local economies. In Arizona, considerable investments have been made in biotechnology through the Technology Research Infrastructure Fund (TRIF) and Governor’s Council on Innovation and Technology. Local and regional economic development agencies, such as the Tucson Regional Economic Opportunities Agency (TREO), see their main role in attracting inward investment and serving industry that is relocating.

The United States provides favourable framework conditions for small business development. Programmes have been developed to create “demand-pull” for R&D and innovation within small businesses. These programmes balance the universities’ traditional tendency to focus on knowledge generation rather than knowledge transfer and diffusion.

The United States has developed many programmes to support SME development. The US Small Business Development Centers have a 30-year track record as an SME service network, annually serving 750,000 SMEs through 1100 centres located in universities and community colleges. In Southern Arizona, both Pima Community College and Cochise College administer small business development centres that offer free consulting, training and referrals to small business owners and entrepreneurs. In view of the weak labour market outcomes and limited SME development among Native Americans, consideration should be given to whether the Tohono O’odham Nation would benefit from a Small Business Development Center hosted by its community college.

The Small Business Technology Transfer Research (STTR) and the Small Business Innovation Research (SBIR) programmes award USD 2 billion to small high-tech businesses every year. Established in 1982, SBIR is the largest US innovation partnership programme, benefitting from a stable budget: 2.5% of federal agencies’ R&D budgets have been set aside for small business awards. SBIR has helped firms cross the “valley of death” by providing funding for proof of concept and prototypes and have created a “demand pull” for RDI within the SMEs, thereby encouraging them to evaluate commercial potential of research results.
Southern Arizona has developed a strong research base and multidisciplinary tradition within the University of Arizona. Nicknamed the optics valley, the Tucson metropolitan region has developed into a hub of light-based industries. Despite considerable investments in the science components of innovation, Southern Arizona remains a low wage economy with wide disparities.

The University of Arizona is the key research institution in Southern Arizona and a national leader in interdisciplinary research. It is strong in R&D expenditures, with nearly USD 407 million in total sponsored research expenditures, ranking 21st among all US research universities in R&D expenditures and 13th among public universities in 2006. The university produces research that is nationally and internationally recognised, and, with the exception of tourism, undertakes research in all fields identified by TREO as important for the regional economy. Close industry links have been forged in high tech fields.

The University of Arizona has a tendency to measure success in innovation by the amount of research expenditure, not the amount of commercial return generated or jobs created. This approach is likely to strengthen with the decreasing state funding for tertiary education. Much of the university’s research infrastructure is subsidised by TRIF/Prop 301 sales tax revenue, which threatens the sustainability of many research programmes.

As a response to the cuts in the state funding, the University of Arizona has shifted its focus on high technology areas with the hope of drawing federal government funding. The collaboration with industry is spurred by public investments from federal government in fields such as defence, biotech & health, and environmental technology. Challenges here are also linked to publicly-driven innovation strategies that may have negative impact on entrepreneurship attitudes. It will also be important to balance the strong high-tech focus with the development of a private sector base in the related industries, and, at the same time, increase collaboration in other fields that are important to the regional economy.

Southern Arizona has chosen the path to develop high technology fields in order to diversify the regional economy and to create high wage employment. The University of Arizona’s College of Optical Science and the local optics industry have made the Tucson metropolitan region a hub of light-based technologies. The optics industry consists of 150 companies, consisting mostly of small companies dedicated to a small niche area generating 4,573 jobs and over USD 650 million in revenue. The region is also home to a number of defence-oriented organisations that play an
important role in the regional innovation system by generating or using R&D. In biosciences, the University of Arizona has established the Bio5 Institute, an interdisciplinary centre that brings together more than 300 researchers. Environmental technology and the agri-food industry feature opportunities for new growth through sustainable energy and resources development. The region is also well positioned to develop solar industry.

Despite efforts made to diversify the economic base of the Southern Arizona, in general, high value added activities continue to have a limited weight in the regional economy, while the average per capita income in Southern Arizona remains consistently below the US average. For example, in Tucson, average wages were, 17.2% below the national average in 2007. Evidence suggests that income inequality will continue to increase with growth in high wage jobs related to the federal government investments and with continued inflow of poor people over the border. Southern Arizona will need to continue its efforts to expand high skill/higher wage jobs in the environmental, health & biotech fields, defence-related fields; and in global service operations that take advantage of the bi-lingual and bi-cultural environment and the ability to reach markets across NAFTA countries and Latin America. Diversification of the economic base, creation of quality jobs and raising the educational attainment levels among the diverse population groups remain key challenges for the region.

The University of Arizona has developed a wide range of mechanisms to facilitate industry-university interface. Despite efforts to rationalise the system, the university continues to feature a fragmented approach to the industry interface. Stronger impacts could be achieved through concerted efforts by all tertiary education institutions.

The university has created a broad range of mechanisms for engaging with business and industry. The plethora of offices, parks, institutes, centres and initiatives have lead to overlap, duplication and confusion among the regional stakeholders and companies. The effectiveness of the innovation infrastructure could be improved by a co-ordinated approach between the sub-units to university-industry collaboration, research and innovation. This could lead to improved communication within the university, cost savings and more approachable structure from the perspective of external stakeholders. Currently, the support for innovation remains fragmented within the university, each department and office developing its own initiatives, often in isolation from each other. There seems to be also limited
attempts to connect technologically-oriented centres with business faculties and with other disciplines to provide support for service sectors.

Industrial engagement is seen by the university faculty as a science and engineering pursuit, rather than a role that could embrace business schools, social sciences and the humanities. A sector such as tourism, which has potential in the region, is not seen as a focus for university activity. Broadening the sectoral orientation and the disciplines that underpin engagement could be beneficial for large and growing clusters in the service sector.

In general, there is limited evidence of the development of a region-wide innovation system. The regional innovation system remains Tucson-centred and underdeveloped, with limited connections between the University of Arizona and community colleges, whose role is vital in developing the skills of the local population. There is currently no mechanism of pooling the knowledge and expertise of all tertiary education institutions to deliver support to industry. The tertiary education institutions, and also the University of Arizona’s different units and offices, did not present themselves as a coherent system, and there was no attempt to set out the collective needs of the region in terms of innovation infrastructure, or for the university and community colleges to co-ordinate their actions in meeting such needs. There appears to be a generally weak focus on meeting the needs to generate high wage jobs in non-high tech fields where Southern Arizona has a comparative advantage. The development of a better functioning, region-wide innovation system would require co-ordination and collaboration among the university and community colleges in their engagement with business and industry.

The economic growth and development in Southern Arizona is strongly related to that of the Mexican state of Sonora, which is a key manufacturing centre for cross-border trade between the US and Mexico. Sustainable development on the Mexican side of the border is of vital importance to Southern Arizona and further efforts should be made to build cross-border regional innovation and skills development system.

There has been considerable encouragement for the university to promote the commercial exploitation of its technologies, but the outcomes remain modest in terms of regional development. There is a need to place less emphasis on financial returns to the university and focus on how the university R&D can support jobs, industry, productivity and innovation in the region.
There has been considerable encouragement for the US universities to promote the commercial exploitation of their technologies. Much of this activity is based on a technology-push model as inventions developed in the university are marketed to potential licensees in industry. The US legal framework for intellectual property rights is helpful in protecting ideas and research of the members of the academia. However, legal costs, lengthy time for patent issuance, limited budgets and the limited long term return on investment have been identified as barriers to commercialisation. As an additional disincentive, the University of Arizona is not allowed to own equity in firms.

In view of its size and research strength, the University of Arizona’s license agreements and patents remain at a low level. The revenue has ranged from USD 1.6 million to USD 583,000 in 2008, revealing a negative trend. It can be expected that the university’s Office of Technology Transfer (OTT) actually loses money, as is the case with many other technology licensing offices in the United States. Considering the fact that the national pharmaceutical industry is concentrated in Southern California and New England, much of the university’s activities are also likely to involve commercialisation outside of the region. With the decreasing state funding for the university, the OTT is faced with pressures to maximise university revenue, rather than spur regional economic growth.

Given the limited scope of the revenues generated by the university and the decreasing trend, broadening the understanding of knowledge exchange, knowledge utilisation and exploitation would be useful. By placing less emphasis on financial returns to the university, and focusing on how the university research can support jobs, industry productivity and innovation in the region, the University of Arizona could move away from the current transaction-based system to a system that is based on developing continuous partnerships with industry, government and other partners. Key aspects of knowledge mobilisation include working to develop open access/open source systems and invention that have low revenue potential but high societal return. This type of broader knowledge transfer would also have the potential to build support among broader segments within the university (beyond high technology) and within non-profit sectors located in the region.

International experience shows that while university technology transfer models may lead to saleable intellectual property and start-ups, they seldom produce enterprises that grow in the region and contribute to regional economic development. The creation of localised supply networks is critical to the process through which innovation is transferred to enterprises enabling the creation of new innovation that transforms and upgrades existing industries. A well functioning regional knowledge transfer model is
based on ongoing relationship between the tertiary education institutions and industry to determine what innovations have the best opportunities for adoption and commercialisation, 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. University entrepreneurship programmes should therefore also support the existing industries and SMEs. The University of Arizona’s College of Optical Sciences is a good practice example, which combines leading edge research with industry collaboration, through multiple mechanisms including joint appointments, industry affiliates programme and student internships.

While population growth is a major strength for Southern Arizona and provides opportunities for economic growth and innovation, the region loses talent with a continuing outmigration of college-educated graduates. Knowledge transfer programmes based on people mobility could help retain talent in the region.

While population growth is a major strength for Southern Arizona and provides opportunities for many industry sectors, the region also suffers from outmigration to Phoenix and other US cities by a population of young, single and college-educated demographic. For example, many graduates of the University of Arizona in science, technology and engineering are recruited by national companies outside the region. Between 2005 and 2007, 547,000 people left Arizona for other states, particularly California. The region also loses talent to the Phoenix metropolitan area.

To improve graduate retention, and quality and attractiveness of local jobs, the University of Arizona, community colleges and key regional and local stakeholders could consider establishing programmes that systematically link tertiary education and industry, faculty, and all students and post-graduates with the local industry. This type of programmes would improve the competitiveness of the local firms through the recruitment of talent and/or the introduction of some form of innovation or new technology garnered from the mobility programme.

Finding ways to increase entrepreneurship would be an effective strategy for regional development in Southern Arizona, but requires
Entrepreneurship plays an important role in generating innovation and stimulating growth in the United States. Americans are twice as likely as adults in Europe and Japan to start a business and grow it rapidly. Small businesses employ 30% of high tech workers such as scientists, engineers and information technology workers. Spin-off companies are also often likely to be locally based and offer the potential of indigenous industrial development.

In recent years, the University of Arizona has made efforts to develop a stronger entrepreneurial spirit among the faculty. The McGuire Entrepreneurship Program and the involvement of the non-profit Desert Angels in technology transfer opens up possibilities for small business creation. There is also growing evidence of enterprise support within the student and graduate community being mainstreamed within some degree programmes and through supporting infrastructures. However, in general, this support is fragmented within the university and with limited collaboration across tertiary education institutions in the region.

The University of Arizona has underutilised potential for entrepreneurship. It has an improving record of generating spin-offs. In 2009, the University of Arizona spun off seven new companies, surpassing the record of six in the previous year and further six companies were “in the pipeline” or in negotiations over IP licensing. About 80% of the university start-ups have remained in Arizona following incorporation, with an improving trend. At the same time, there is a wide diversity among the different centres and schools in terms of entrepreneurship outcomes. Furthermore, there appears to be a lack of focus on the job generation aspects. This is reflected by the fact that the employment figures of spin-offs are not available and no data is collected about the university start-ups that often generate more jobs than academically driven high tech spin-offs.

Concerted efforts are needed to support entrepreneurship activities within the university and among the university and community colleges for the benefit of Southern Arizona. The good practice examples provided by the McGuire Center and some of the most entrepreneurial units should be shared and mobilised. There is also a need to extend the current entrepreneurship programmes and tie them more closely to regional efforts and community engagement activities.

The following measures would promote innovation in Southern Arizona:
• A systemic perspective should be applied in developing a regional development strategy by improving the connectivity in the regional innovation system through stronger collaboration and networking as well as through consensus building for economic development and partnering between the educational institutions and industries in order to create close research collaboration across tertiary education and research and industry, particularly small and medium-sized enterprises. Consistent innovation indicators should be developed and monitored over time.

• The state government and regional/local agencies should ensure that research on clusters and the demands of industry extend into the service sector. Clusters should also be conceptualised as cutting across the manufacturing-service divide. For example, manufacturing innovations should increasingly incorporate service components. Tertiary education institutions should be encouraged to draw upon business schools, humanities and social sciences in providing assistance to business.

• Southern Arizona, its tertiary education institutions, and the public and private sectors should make systematic concerted efforts to support new business formation and build an environment and mechanisms that support start-up and entrepreneurial companies through aligning incentives for a sustained period of time. Building on the experience of the University of Arizona’s McGuire Entrepreneurship Program, the tertiary education institutions should support entrepreneurship throughout the curriculum and build comprehensive support programmes encompassing entrepreneurship training, practical experience of creating new businesses for groups of students; and incubation and hatchery facilities together with seed funds for new graduate ventures. Private funding sources willing to invest in “ideas” rather than real estate should be strengthened.

• The tertiary education institutions should play a more active role in helping the region to build a more diversified and robust economy based on knowledge and innovation. The University of Arizona should broaden its understanding of knowledge transfer, knowledge utilisation and exploitation and place less emphasis on financial return to the university. By focusing on how the university research can support jobs, industry productivity and innovation in the region, the university Technology Transfer Offices (TTOs) could move towards a system that is based on continuous collaboration with industry, government and other partners. There should be stronger emphasis on the development of open access/open source systems and interventions with low revenue potential but high potential to yield societal returns in order to build support among broader segments within tertiary education institutions.
ASSESSMENT AND RECOMMENDATIONS

(beyond business and engineering faculties) and within non-profit sectors in the cross border region.

- State government and regional agencies should balance the current focus on high tech R&D with considerable efforts to develop general competencies among the population to help adjustments to rapid changes in the labour market and to facilitate lifelong learning. Systematic concerted efforts should be made by the State of Arizona, educational institutions and key stakeholders to raise the levels of education attainment.

- The tertiary education institutions should focus their concerted efforts on challenge-driven innovation on the key issues in the cross border region, such as water, Hispanic/border health and border security in its broader sense, and use the region as a “laboratory” for research, knowledge transfer and outreach to reach global levels of excellence. Job creation should be seen as the focus of innovation activities.

- Incentives for tertiary education institutions should be strengthened to increase their capacity to act as technology transfer “agents” to bring non-local knowledge to the region and to create community partnerships. Incentives for tertiary education institutions and their staff to engage in local and regional development should be developed. The state government should seek to encourage greater collaboration between tertiary education institutions through joint investments in research facilities and incentive programmes.

Social, cultural and environmental development in Southern Arizona

Population growth, ethnic diversity and the vicinity of Mexico are key assets for Southern Arizona, but also pose challenges. Tertiary education institutions have generated a wide variety of social and cultural programmes, initiatives and facilities that capitalise on the assets and address these challenges.

The ethnically and economically diverse population is both an asset and a challenge for the economic, social and cultural development of Southern Arizona. The region’s large Hispanic population is in the prime working age and has many children. In the near future, there will be a large influx of new, non-traditional students, who will constitute a growing portion of the population available to fill skilled jobs. Migration and ethnic diversity also
pose social and cultural challenges with respect to integration and social inclusion.

The University of Arizona and community colleges have generated a wide variety of programmes, initiatives and facilities to address the key social and cultural challenges in the region. Examples range from help and assistance to migrants or the provision of health care, legal aid, women advocacy and other services to individuals and communities in need, to personal enrichment programmes, neighbourhood planning, policy advice and cultural performances and facilities. Institutions also contribute to the maintenance and preservation of the region’s indigenous languages, folklore and traditions.

The University of Arizona and community colleges actively contribute to social and cultural development using the region as a “laboratory” for their research, outreach and student learning. In collaboration with stakeholders, they act as conduits for information and funding between state and federal agencies, Native nations, local school districts, businesses, military personnel, young people and at-risk populations, such as homeless communities. They serve as brokers in regional policy-making between communities; non-profit organisations and government agencies; advocating for at-risk populations in public health policy; preparing new citizens for civic duties; and eliminating public fears and xenophobia, etc. In key areas, such as youth programmes, they partner with each other to build local capacity.

The diverse programmes and projects are fragmented, built on separate and non-coordinated initiatives stemming more from specific circumstances rather than an overarching vision of needs and joint efforts. Maintaining the active visibility in social and cultural development is important for tertiary education during the period of economic crisis, but will require prioritisation and co-ordination of efforts.

The opportunities for sustainable and extended third mission activities of education institutions lie in building the region’s reputation as a positive model in addressing the demographic transition in the region and the needs of its diverse population. These areas should be recognised by the public and private stakeholders as important to the region’s future. Tertiary education institutions’ collaborative engagement in these arenas can enhance support for tertiary education, influence public opinion and emphasise their critical role in social and economic leadership.
There is scope for stronger collaboration to build joint capacity and to foster joint efforts in order to ensure that limited resources are not spread thinly and that the projects will generate multiplier effects. Sustainable engagement will require prioritisation; building critical mass; pooling resources; new research incentives; re-conceiving incentives for faculty and staff responsibilities; and developing new approaches and metrics to measure progress and participation.

There is a risk that the university’s strong focus on high technology fields will divert the attention from the key challenges in the region. Despite world class examples, such as SIROW and health interventions, social and cultural engagement has developed inconsistently without system-wide support. In economic downturn, the challenge for the institutions is to identify and prioritise critical social, cultural and environmental issues and gaps in knowledge and action where they can make – individually and collectively – contributions to build regional sustainability through critical mass, collaborative effort and long term action.

Southern Arizona needs to do more to retain and attract talent. The Tucson Metropolitan Region is the engine of regional development and a “mini-mecca” of arts. Building on the expertise of the university, public-private efforts are needed to develop a culturally vibrant and socially inclusive Downtown Tucson, renowned for the quality of its sustainable urban design.

The Tucson metropolitan region plays an important role in the development of Southern Arizona. It is home to the majority of jobs, firms and tertiary education institutions and the focal point of innovation, entrepreneurship and economic growth, increasing region’s global competitiveness. It is also a place of natural beauty with diverse people, rich cultural heritage and a wide variety of outdoor and diverse cultural opportunities. The University of Arizona supports the city’s cultural strength through its education programmes, performances and other outreach activities, art venues and museums.

Cultural and creative industries can contribute to the growth and development of Southern Arizona in an indirect way, through attraction and retention of talent and knowledge-intensive industries that tend to move to regions with a high concentration of talents and creative workers. In spite of many positive attributes, the Tucson city region has not sufficiently developed its cultural potential, which is evidenced in brain drain and out-
migration of population of a young, single and college-educated demographic.

Building on the expertise within its university, Tucson could also strive to become known for the quality and ambition of its physical planning, innovative approaches to socially and environmentally sustainable city development, as well as environmental and urban planners’ ability to integrate the new with the old Pueblo and Mission style architecture. In the first instance, there should be a more serious attempt to extend the “Downtown Tucson” to span from the historical core of downtown to the University of Arizona. This would help draw the community onto the campus and campus into the community. The new approach would call for improved public transportation; creation of a more vibrant downtown, with around-the-clock activity; and linking it with surrounding neighbourhoods through developing a pedestrian-friendly region with safe public spaces, bike paths and public cycle hire network. International examples in this domain come from Barcelona, Spain, where the city government has developed a model of urban development that transforms old industrial and/or distressed areas into multi-functional urban areas and places universities in the core of these developments.

Economic development can only be sustainable when it is accompanied by measures designed to reduce poverty, social exclusion and environmental problems. Tucson and Southern Arizona would benefit from an integrated public-private multi-stakeholder approach that not only encourages growth and jobs, but also pursues social, cultural and environmental objectives. Economically disadvantaged and undocumented immigrants represent a significant portion of the regional population. Strong efforts are needed to foster economic growth and educational opportunities for all.

Southern Arizona covers a large geographical area with a sparsely distributed population. Water management, solar energy applications and climate change are important to the region. The green sector can be one of the key sectors of economic development. While the University of Arizona is making significant contributions to the green sector, there is scope for further expansion through stronger collaboration and skills development…

The University of Arizona has taken a lead in addressing local to global climate change issues and policies, including economic impacts and the development of urban planning, architecture, transportation and water
management. Its Water Resources Research Center has a focus is on assisting Arizona communities with water management, while the Arizona Research Institute for Solar Energy aims to drive innovation between university and private industry to achieve solar energy solutions.

First movers in green research can benefit from substantial returns on investment. Deloitte’s 2009 survey on Global Trends in Venture Capital reports that, despite the economic crisis, 63% of venture capitalists anticipate an increase in their investment in clean-tech, the highest percentage among all sectors considered. Green jobs are projected to increase to several millions worldwide by 2030, most of them in a small number of innovative regions. Green technologies rely on local know-how and generate new applications and higher demand for technologies developed by traditional industries.

Given the critical role that the development of sustainable energy and energy efficiency will play in the future of the US economy and to benefit from economic gains, green innovation capacities need to be unlocked in Southern Arizona through cluster policies. Many OECD countries are building partnerships between government, industry and academia as eco-innovation clusters. These clusters merge skill development and education, cutting-edge research in environmental technologies and job creation through spin-offs, venture capital and integration of enterprises. Joint green action and research would also contribute to developing a more co-ordinated regional innovation system in Southern Arizona.

While agriculture employment is on a decline, it remains a key sector in the Arizona economy. At the same time, it is under increasing pressure as regards to land use and water management. The University of Arizona’s College of Agriculture and Life Sciences’ Cooperative Extension Service’s brings research-based information into Arizona agri-business communities with focus on water management, climate change, sustainable agriculture, range management and youth development. More structured R&D, dissemination and commercialisation efforts targeted at the local agricultural and agri-industry structure are needed to reduce emissions related to agriculture, and to ensure food security and sustainable rural development.

The university and community colleges could play a more important role in supporting technical, organisational and process improvements for eco-efficiency of the existing industry, i.e. exploring ways to create more goods and services while using fewer resources and creating less waste and pollution. Southern Arizona does not seem to have a strong portfolio of programmes targeting emission reduction in businesses that have been initiated by universities and community colleges. Experience from OECD countries shows that tertiary education institutions can become successful
partners of local businesses who want to upgrade their environmental standards.

Many national and regional governments in the OECD area are developing green skills strategies, including new industry-recognised credentials and training packages for workers in traditional occupations, by facilitating re-training and efficient mobility of learners between vocational institutes, universities and industries. In Southern Arizona, the creation of highly skilled human capital is critical for improving the opportunities for wider market penetration of renewable energy and low carbon technologies. Skill creation for green jobs could be effectively organised at the regional level by pooling the resources of industry and the educational institutions. Southern Arizona could also take steps to anticipate the employment effects and labour reallocation needs across industries. Partnerships between the university, community colleges and industrial associations could stimulate innovation in the modes of delivery of education and training.

The following measures would promote social, cultural and environmental in Southern Arizona:

• To boost green growth and eco-innovation, there should be collaboration between tertiary education institutions and industry, and among the institutions themselves; for example, through collaborative platforms for eco-innovation and other cluster-based initiatives. Skill creation for green jobs should be organised by pooling learning resources of educational institutions and industries in the region and providing flexible pathways between institutions.

• In collaboration with Southern Arizona’s tertiary education institutions, regional and local agencies should develop a strategy that sees arts and culture as an agent of development through: i) a direct benefit in enhancing the quality of life of the diverse population; ii) indirect economic benefits in attracting and retaining talent that can drive the knowledge society; and iii) a direct contribution to the creative industries through enterprise formation, growth, productivity and employment. This strategy should address the needs of the region’s diverse communities and also enhance the internationalisation of the region.

• Southern Arizona’s tertiary education institutions should support cultural development by increasing multi-stakeholder, public-private efforts to support arts and culture, and entrepreneurial skills among students of arts, humanities and social sciences. Given the high proportion of self-employment and small business in the creative
sector, the universities and community colleges should contribute to the development of regional creative economy by developing and expanding programmes in entrepreneurship and non-profit management both in formal degree programmes and through extension efforts.

- Building on the expertise within Southern Arizona’s tertiary education institutions, regional and local agencies should develop Downtown Tucson into an attractive urban centre known for the quality and ambition of its physical planning. It would span from the historical core of the downtown area to the University of Arizona. The new approach would call for improved public transportation, creation of a more vibrant downtown and linking it with surrounding neighbourhoods, developing a pedestrian-friendly region with safe public spaces, bike paths and public cycle hire network.

- In collaboration with Southern Arizona’s tertiary education institutions, regional and local agencies should adopt an integrated public-private multi-stakeholder approach to regional and city development that not only encourages growth and jobs, but also pursues social, cultural and environmental objectives.

- Southern Arizona’s tertiary education institutions should engage in long-term community development seeking ways to empower communities to find their own solutions to economic, social, cultural and environmental challenges which are global, national and local in nature. They should continue to collaborate with authorities, schools, NGOs and the private sector, to reach out to under-served communities, such as migrants, to ensure social and economic cohesion. They should scale up current activities in a systematic way, including long term multi-stakeholder collaboration with schools to raise aspiration among youth in under-served communities. They should provide training and capacity building so that community can do the work themselves; and continue to see the region as a laboratory for developing research, students’ work-based and experiential learning and developmental projects in different fields. Tertiary education institutions should reward and recognise faculty who are involved in these activities. Provide centralised support services for student and staff for community engagement (for example, internship oversight).

- In collaboration with Southern Arizona’s tertiary education institutions, regional and local agencies should develop a forum for social, cultural and environmental development. A systematic
exchange of information should be put in place to track and monitor different initiatives and their outcomes and identify best practices for publication and policy fine-tuning. Such a forum could organise thematic events with regular information retrieval and exchange facilitated by a dedicated website, and the installation and/or development of new communication technologies, such as long distance learning capabilities that can bridge the physical distances between tertiary education institutions and community stakeholders not only in Southern Arizona, but also in Northern Mexico. As a first step, the tertiary education institutions’ current connections, initiatives and projects involving stakeholder collaboration, community development and/or outreach should be mapped.

- Southern Arizona’s tertiary education institutions should improve the monitoring and follow-up of the success and results of the initiatives, projects and programmes to show return on public investment. The lack of robust and comparable data constrains the visibility and impact of the tertiary education institutions’ activities. It also makes it difficult to measure the success or failure of programmes. Building on existing models, capacity should be developed in regional data gathering and sharing regional data repositories and technical skills associated with using regional data.

- In collaboration with Southern Arizona’s tertiary education institutions, regional and local agencies should capitalise on Arizona’s multicultural heritage. The University of Arizona should take a leadership role in regional initiatives to develop strategies to integrate immigrants, including those from families with low educational attainment. The university would benefit from an active role in international study of immigration and integration, and from participation and implementation of relevant integration plans and seeking multidisciplinary approach in its community action. The university should continue to raise public officials’ and other stakeholders’ awareness of labour market and educational strategies and encourage positive action.

Steering, funding and capacity building

One of the main issues impeding tertiary education development in the State of Arizona is the fragmented governance architecture and the absence of a state-wide co-ordinating
structure that brings together universities and community colleges. There is a need to create appropriate mechanisms to articulate a long-term vision and implement an integrated development strategy for all tertiary education institutions.

One of the main issues impeding tertiary education development in the State of Arizona is the fragmented governance architecture and the absence of a state-wide co-ordinating structure and appropriate mechanisms to articulate a long-term vision and implement an integrated development strategy for all tertiary education institutions. The authorities and interested parties in the Southern Arizona region should work together with the other regions in the State to propose the establishment of a tertiary education co-ordinating body that would help define state-wide goals, policies and priorities, in line with the recommendations of the 2006 Governor’s initiative.

The advantages of a system-wide governance model is the ability to plan more effectively for the tertiary education needs of the region; to co-ordinate missions and programmes; to encourage an appropriate division of labour among institutions; to co-ordinate missions and programmes; and to maintain appropriate data bases for institutional and system policy research. A comprehensive approach also provides the ability to reallocate resources among institutions as needed; to shift programmes and staff among institutions and facilities; to merge programmes or even institutions; and to close programmes, facilities, and even institutions, that are redundant, too expensive, of low quality, or simply too small in scale to be cost-effective. Finally, it allows presenting a strong and unified political front to the state authorities and the legislature in order to maximise the case for sufficient and stable public resources.

To steer the future of tertiary education in the State of Arizona, the proposed co-ordinating body will need to define a comprehensive vision which outlines clear qualitative and quantitative goals and confirms the respective contribution of each type of tertiary education institution. Despite the present financial woes, the California master plan remains a relevant model of careful articulation and division of responsibilities among the various institutions in a state system (research universities, teaching universities and community colleges).

An important dimension of good governance consists of putting in place an adequate information system to monitor the performance of tertiary education in the State of Arizona and benchmark its progress with appropriate comparators in the US and among other OECD countries.
There is an urgent need for a sustainable financial expansion plan reflecting a long-term commitment on the part of the Arizona legislature to support tertiary education and to increase educational attainment.

Any attempt to better co-ordinate tertiary education development in Arizona and increase educational attainment is a substantial challenge, unless it is backed by a sustainable financial expansion plan reflecting a long-term commitment on the part of the legislature. A two-pronged strategy could be articulated and implemented to achieve this goal: i) mobilise a greater share of public expenditures for tertiary education in the State of Arizona budget; and ii) increase resource diversification in the public universities. Public funding for tertiary education has declined steadily in the past two decades, endangering the ability of the University of Arizona and the community colleges to continue fulfilling their public good function and threatening their academic quality.

The drastic cuts in response to the economic and financial crisis have amplified a long term negative evolution which threatens the sustainability of Arizona State’s public institutions. A comparison of the state allocation for tertiary education between the fiscal year 1999/2000 and fiscal year 2009/10 indicates that, while the state government general fund increased by 57.7% over the period, public resources for tertiary education institutions rose only by 20.2% for universities and a mere 3.9% for community colleges. The state of Arizona cannot realistically expect to achieve further progress on the tertiary education front, or even protect the achievements thus far, unless its authorities and legislature reach a consensus to increase public funding for the sector in a significant way, and make a long-term commitment to finance tertiary education on the basis of clear criteria aligning needs, performance and resources in an objective and transparent manner.

Any increases in tuition fees should go hand in hand with more student aid from the state. The University of Arizona could also amplify its efforts to increase its endowment.

The University of Arizona will undoubtedly continue to compete successfully for local and federal research grants. It has also the potential to generate additional resources in two complementary ways: by augmenting tuition fees and through fund-raising efforts.
Tuition fee increases should go hand in hand with more student aid funding from the State, to avoid creating two categories of students: those who can afford to enrol in the university, and those who would be only able to afford a community college.

The University of Arizona could amplify its efforts to beef up its endowment, currently estimated at USD 335 million. The fund raising efforts of the University of Arizona and other public tertiary education institutions in Arizona could be supported through a matching grant scheme similar to ones implemented in other US States, or in other OECD countries. The earlier local experience with a matching programme through the Science Foundation of Arizona shows that private donors are willing to contribute, provided there is a real commitment on the state side.

Partnerships within Southern Arizona between tertiary education institutions and the regional and local partners, acting in concert with each other, are key to attracting talent and investments and partnering with other regions and tertiary education institutions globally. For this interaction to take place, capacity – skills and resources – needs to be built in regional agencies and stakeholders as well as tertiary education institutions.

Tertiary education institutions in Southern Arizona are engaged in diverse collaboration with regional and local industry and community partners. Much of this collaboration is on an ad hoc basis without long-term planning, adequate resources and monitoring of the results. Furthermore, the fragmented nature of the innovation system means both the innovation actors and tertiary education institutions are not fully realising their potential capacity.

Permanent, long-term collaboration is needed to address the key challenges and opportunities in Southern Arizona. Better co-ordination, building critical mass and developing evaluation measures would benefit the region and bring costs savings. Collaborative work should be supported by a detailed knowledge of the needs and opportunities in the region and the knowledge of tertiary education institutions’ teaching and research portfolio.

There is a lack of national, state and institutional policies to improve the incentive structures to support the regional and local engagement of universities and their faculty and staff. The lack of incentives is a common feature in many tertiary education institutions and countries where regional
engagement is perceived not only as a secondary role for universities when compared with research, but also as a detracting activity. In Southern Arizona, the recruitment, and promotion of the university staff are nearly exclusively determined by research performance, measured primarily by publications. The “third mission” activities have been traditionally absent from the list of factors that have an impact on faculty career development. Tertiary education institutions need to incorporate local and regional development activities in the criteria for staff promotion and tenure.

The following measures would promote steering, sustainability and capacity building in Southern Arizona tertiary education:

- To improve the overall governance of the regional tertiary education system, the authorities and interested parties in Southern Arizona should work together with the other regions in the State to propose the establishment of a tertiary education co-ordinating body that would help define state-wide goals, policies and priorities.

- The Arizona legislature should make a long-term commitment to increase educational attainment in Arizona backed by a sustainable financial expansion plan. A two-pronged strategy could be articulated and implemented to achieve this goal: i) mobilise a greater share of public expenditures for tertiary education in the State of Arizona budget; and ii) increase resource diversification in the public universities. Furthermore, an adequate information system needs to be established to monitor the performance of tertiary education in Arizona and benchmark its progress with appropriate comparators in the US and among other OECD countries.

- At the regional/local level, a permanent partnership structure of key stakeholders from local and regional authorities, business and industry, the community colleges and the University of Arizona should be established to provide a focus for dialogue with tertiary education in relation to its contribution to regional and local development, and identify and develop leaders within the public and private sectors to populate this partnership structure. A clearly articulated long-term integrated strategy should be developed to drive the economic, social, cultural and environmental development of the Tucson metropolitan region and Southern Arizona and the state and to complement the current project-based approached. Resources of tertiary education institutions should be mobilised in the preparation and implementation of regional and urban strategies.
• Tertiary education institutions should build on existing links and initiatives that align them with the regional needs in order to develop a common vision of local and regional development, and support this vision with a strategy, milestones and funding in order to ensure that local engagement is part of tertiary education institutions’ activities and reflected in their development plans.

• Tertiary education institutions should review staff recruitment, hiring and reward systems so as to include the regional development agenda. They should create mechanisms to systematically monitor and evaluate the activities in this area, to share good practice within their institution and benchmark this experience with other organisations and localities.

• Tertiary education institutions should develop senior management teams to deliver the corporate response expected by regional and local stakeholders without discouraging entrepreneurial academics.
Universities and other higher education institutions can play a key role in human capital development and innovation systems in their cities and regions. In the context of global economic and financial crisis, OECD countries are seeking to mobilise higher education institutions (HEIs) to support more strongly their economic, social and cultural development.

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 proactive higher education institutions. As a result, 14 regions in 11 countries have undergone the OECD review process in 2008-11.

This OECD Review of Higher Education in Regional Development of Southern Arizona in the United States of America explores a range of policy measures and institutional reforms to mobilise higher education for the development of the region. It is part of the series of the OECD reviews of Higher Education in Regional and City Development. The reviews analyse how the higher education system impacts local and regional development and help how this impact can be improved. In addition to human capital and skills development, technology transfer and business innovation, the reviews also consider higher education’s contribution to social, cultural and environmental development and regional capacity building.

To know more about the OECD review process and requirements, visit Higher Education and Regions’ website at www.oecd.org/edu/imhe/regionaldevelopment.