



Mountain in Anhui Province

Science and technology in Central China

In central China, a science renaissance is happening. Away from the hectic coastal cities, scientists and entrepreneurs have found new opportunities in ancient cities, such as Xi'an, Zhengzhou, and Wuhan. This region also receives abundant funding for research and education, but the cost of living is lower than in the big cities. In recent years, universities in central China have been producing high-quality research and forging collaborations in key disciplines, such as hydraulic engineering, aerospace technology, and translational medicine. New urban centers, built using sustainable designs and high-tech infrastructure, are popping up and attracting investments from Chinese as well as global firms. As a result, this region is becoming a new hub for researchers and tech companies to launch exciting projects in science and engineering. **By Wayne Peng**

Central China is less known to the West than the major coastal metropolises like Beijing and Shanghai; however, this has not always been the case. The entry point for Western goods and ideas shifted from inland China to the coast in the 12th century. Prior to this, the capitals of successive Chinese dynasties were to be found inland and were considered by many to be amongst the largest cities in the world. At the peak of the Tang dynasty, around 750 CE, more than a million people lived in Chang'an (present day Xi'an)—where trade with Europe and central Asia began via the Silk Road.

Today, as the coastal cities approach developmental saturation, Chinese policy makers, scientists, and entrepreneurs are taking a fresh look at the inland region's rich cultural and natural resources. Central China is a loosely defined geographical area that usually includes the provinces of Shanxi, Shaanxi, Henan, and Hubei, but can also refer to the Anhui, Hunan, and Jiangxi provinces. At the northern end, ancient cities dot the banks of the Yellow River and its major tributaries—a region that is considered the cradle of Chinese

civilization. The Yangtze River runs along the southern border, serving as an artery for transportation and providing hydraulic resources.

Here, we highlight the region's rise in scientific research and education, as well as the push to recruit more talent and attract technology investments. The examples highlighted here showcase the renaissance of central China and the new opportunities in this "old" region.

Strengthening international collaborations

Zhou Chuangbing became president of Nanchang University in 2013 after spearheading science and technology affairs at Wuhan University in Hubei province for more than a decade. As a leading expert on rock mechanics and hydraulic engineering in China, Zhou has dedicated his career to improving the safety and environmental sustainability of hydraulic engineering projects. "China leads the world in many hydraulic engineering achievements," says Zhou. Perhaps the best known example is the Three Gorges Project, the largest hydropower station in the world, which is only a few hundred miles west of Nanchang on the Yangtze River.

Zhou's engineering philosophy is "safety always comes first." He adds, "We need to protect the ecological habitats at the site of any major hydraulic engineering project." Safety and sustainability are relatively new concepts in the booming Chinese economy. These concepts exemplify the pioneering, future-driven vision that Zhou has brought with him to Nanchang University, which is famous in China for research on the science and manufacturing of light-emitting diodes, food science and engineering, and medicine.

Desiring to build upon Nanchang's strengths, Zhou sees a need to internationalize the university's scientific research and education. He explains that central China's location can sometimes hinder the recruitment of top talent directly from abroad; however, he encourages young faculty members to seek opportunities to collaborate with researchers outside of China and to spend time overseas to learn how critical thinking is carried out. Zhou hopes that this type of exposure will improve Nanchang's scientists' abilities to formulate quality research questions. "When [our faculty members] come back after a period of training abroad, they become much better scientists," says Zhou. With a strong push for international collaboration, Zhou hopes to elevate the academic profile of Nanchang University by helping its existing students and faculty members succeed in education and research.

Facilitating large-scale projects

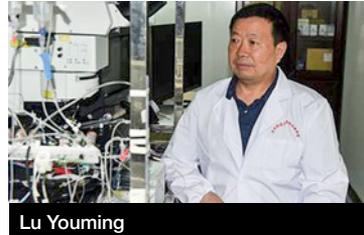
Further up the Yangtze River, in Wuhan, **Lu Youming** is building a new brain research institute at Huazhong University of Science and Technology (HUST) Tongji Medical College. When Lu was first nominated for the Chinese government's highly selective Thousand Talents Program in 2008, he was running a lab at Louisiana State University Health Sciences Center in New Orleans. By that time, Lu had already established himself as a key contributor to the field of neuroscience, particularly in glutamate receptor research; however, he wanted to make a greater impact and thought there were two ways to do so: find something that will change clinical practice **continued**>

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Building at Huazhong University of Science and Technology



Lu Youming

or make a discovery that is important enough to alter the textbooks.

Lu's research on death-associated protein kinase 1 (DAPK1) had already been making strides toward the clinic for stroke management. He wanted to further investigate some fundamental scientific questions, but the work would require large-scale 'omics studies. It's a big challenge to fund such endeavors in the United States, Lu points out, adding that "even five R01 research grants cannot support the functional genomic work necessary to answer the key questions in neuroscience, such as the specific function of a gene expressed in individual brain cells." Science funding is different in China, Lu explains. "What takes a nationwide collaboration to accomplish in the United States can be supported by a handful of projects funded by the central government or the provincial authorities in the region."

In 2011, after touring a dozen major universities around China, Lu settled down at HUST and began building a brain research center. Instead of joining the crowded research hubs in Beijing or Shanghai, Lu believed he could make a larger difference by tapping into the local resources in Wuhan at HUST. Lu's team has already generated 16,000 knockout mouse lines in a systematic attempt to dissect out the function of genes expressed in the brain, and a new research building is already underway (scheduled for completion in 2016) to house this vast resource. Lu has also secured 170 million yuan (US\$26 million) in funding to recruit top research talent, mainly through the government's Thousand Young Talents Program. "In two years," predicts Lu, "there will be more Thousand Young Talents Program scholars in Wuhan than in Shanghai."

Funding and resources are not an issue for doing scientific research in China. The real challenge is "to be able to identify and study important questions [that are at the forefront] of science," says Lu. For young scientists starting a career in China, Lu has two important pieces of advice: be willing to change and improve the research environment and do not single-mindedly focus on publishing papers. He encourages young scientists at his institute to spend more time on innovative thinking and to avoid chasing hot topics or doing incremental experiments. For scientists looking to relocate to China, Lu suggests visiting prospective institutes multiple times to really understand the environment and the support offered, because every institute in China has a unique culture.

Finding coastal connections

By building connections with the more established coastal

region, Xi'an-based Northwestern Polytechnical University (NPU) hopes to boost its status via an expansion at Research & Development Institute in Shenzhen (R&DIS) in Guangdong Province under the guidance of Dean **Shang Peng**.

The economic reforms of the 1980s in China led to conditions that limited growth in the technology sector in "special economy zones" like Shenzhen. Though private investments and the entrepreneurial spirit were plentiful in Shenzhen, its economy was almost entirely based on manufactured exports, with little focus on technology and innovation. To ensure the city's long-term success, the Shenzhen municipal government began inviting universities to bring technology, higher-education curricula, and scholars to the area. In 1999, NPU and other major Chinese universities began setting up satellite campuses, such as R&DIS, in Shenzhen. NPU has long been a leader in aerospace science and engineering education in China and thus made these fields the focus of R&DIS. In return, NPU gained access to venture capital-backed tech transfer resources and the entrepreneurial know-how in Shenzhen.

Last year, NPU received an empty plot of land within a designated high-tech zone, prompting the university to expand R&DIS into a full-fledged research and development center. Shang is now tasked with the major expansion. He already has a track record of success after having built the School of Life Science and a key laboratory at the NPU from scratch. With a background in biomedical engineering and pharmacology, Shang joined NPU 10 years ago to construct the school at a university that specialized mainly in airplanes and rockets. Over the past decade, research in extreme-environment biology, gravitational biology, and aerospace medicine, such as bone metabolism during space flight, has flourished under Shang's guidance.

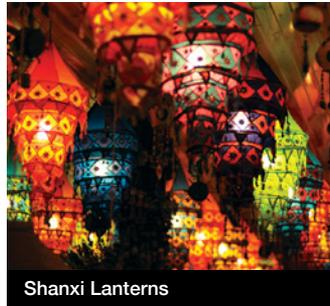
At the newly expanded R&DIS, "apart from focus on the research and development of unmanned aerial vehicles for civil use, human health research will be another new major focus," explains Shang. NPU will build a 28-story research facility with 50,000 square meters of floor space on the new plot. Establishing this coastal connection with Shenzhen is "good for NPU in terms of recruitment, technology transfer, industrialization, and internationalization," says Shang, but it is mutually beneficial in that central China in turn "helps recruit high-level talent and supplies educational resources to the coast." In addition, he sees new concepts—such as entrepreneurship, teamwork, resilience to failure, and service-oriented operations—and access to venture capital flowing back to Xi'an, which further elevates the academic profile of NPU.

Building a "sponge city"

Xianyang, the ancient capital of the Qin dynasty, is a small city west of Xi'an. Against this historical backdrop, contemporary urban planning concepts are being used to build five new cities between Xi'an and Xianyang—collectively called the "Xixian New Area"—to accommodate the growing population and attract technology investments to the region. The arid climate and archaeological sites present unique challenges for new development in this area.

One such place, the Fengxi New City, is designed as a 143-square-kilometer high-tech park and an urban service center. "We have taken the latest urban development concepts to plan Fengxi New City from scratch," says **Kang Zhenfeng**, deputy director of the managing committee for Fengxi New City. The city plan is plotted with parks and green belts at the center to avoid the type of concentric sprawl **continued**>

“We have designed a ‘sponge city’ [Fengxi New City] that uniquely fits the climate of northern China, with an underground reservoir and an extensive network of collection ducts to save rainwater for the dry season.”
– Kang Zhenfeng



Featured Participants

Fengxi New City
www.fcfx.gov.cn/fxzw/
 [Chinese]

Huazhong University of Science and Technology
english.hust.edu.cn

Nanchang University
www.ncu.edu.cn/language/english.html

Research & Development Institute in Shenzhen, Northwestern Polytechnical University
www.nwpu.sz.cn [Chinese]

Tongji Hospital
english.tjh.com.cn

Zhengzhou National High-Tech Incubator
www.zzjq.gov.cn [Chinese]

found in Beijing and many other Chinese cities that are plagued by traffic and air pollution. Other innovative concepts have been adapted to facilitate ecological preservation, green-energy use, and rainwater conservation. The latter is particularly important in northern China because of the uneven rainfall between the rainy and dry seasons. “We have designed a ‘sponge city’ that uniquely fits the climate of northern China, with an underground reservoir and an extensive network of collection ducts to save rainwater for the dry season,” says Kang. With a high-tech city in mind, the planners of Fengxi New City have laid a network of conduits for electrical and data cables underneath the roads, eliminating the need to dig in the future.

“Fengxi New City strives to lead in China in terms of urban planning,” says Kang, and the innovations have already created a very attractive environment for the type of high-tech companies intended for the area, such as Microsoft and China Telecom. Fengxi is offering comprehensive packages to attract more tech companies, especially those in the areas of cloud computing and big data. It also partners with universities in nearby Xi’an to further strengthen the pool of highly skilled labor in information technology. “Sponge city” is not just a literal design that balances rainfall between seasons, but also a vivid metaphor for the area’s ability to absorb investments and talent from other regions of China and all over the world.

Incubating high-tech startups

Technology recruitment is also taking place in other ancient cities within central China. In Zhengzhou, **Ma Gencan**, director of the National High-Tech Incubator in the Zhengzhou National Economic and Technological Development Zone (ZNETDZ), has set his 2015 priority as talent recruitment. Despite ZNETDZ’s success, “the challenge in front of us is a shortage of talent and resources for science education,” he says.

Since its inception in 1993, ZNETDZ has successfully

established the city as a pivotal distribution hub for goods to all major Chinese markets by taking advantage of its central location and extensive network of railroads, highways, and airlines that all converge in the area. In 2013, a cargo train began running from Zhengzhou through western China, Kazakhstan, Russia, Belarus, and Poland to Hamburg, Germany. This train moves Chinese exports to Europe and returns with automobiles and other goods for the growing Chinese consumer market. The train has cut the transportation time for European goods coming in from several weeks to 15 days and has greatly enhanced safety. As a result, Zhengzhou is now the largest automobile manufacturing and distribution center in China.

The High-Tech Incubator within ZNETDZ was established in 1998 to offer policy, funding, and consulting services to (the now over 500) startups and to help them commercialize nascent technology products. Focusing on three key areas—sustainability technology, information technology, and health care—and armed with funding support from the provincial government, Ma is actively recruiting top tech experts from abroad and other regions in China. “More importantly, the region needs to keep local talent from migrating out,” he says. Recruiting and retaining talent is more critical than ever as technology investments begin to come back to the region and demand more support from the local talent pool.

It may be true that, by many objective measures, central China still lags behind other regions in terms of scientific research, science education, and technological investments. However, with its rich culture, abundant labor force, and central location between major cities, central China is poised to become a new center of scientific capital and technological innovation in the near future.

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